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CHECKED			TITLE: WING & EMPENNAGE ANALYSIS	MODEL L-185
APPROVED				REPORT NO. 11056

INTRODUCTION

The purpose of this report is to substantiate the structural integrity of the wing and empennage components of the Model L-185 airplane, in accordance with the requirements of Contract SP 1913.

The stress analysis contained herein is based on the airplane external loads as presented in LR 11055. "BASIC STRUCTURAL LOADS".

The first part of this report presents the analysis of the wing primary box structure, including design loads, section properties, internal loads and margins of safety.

The second part of this report presents the analysis of the empennage, including the stabilizer main box structure and attaching fittings and the fin main beams, torque cell and attaching fittings.

Further verification of the structural integrity of the wing and empennage components is provided by the airplane static test program, the results of which are presented in LR 10571, "STATIC TEST."

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REFERENCESLOCKHEED REPORTS:

LR 10571 Static Test
 LR 11055 Basic Structural Loads
 LR 11057 Fuselage Analysis
 LR 11058 Landing Gear & Controls Analysis

MISCELLANEOUS:

Lockheed Stress Memo Manual
 Lockheed Standards Manual
 Lockheed Design Handbook
 ANC-5
 Roark, "Formulas for Stress and Strain"
 Miles and Newell, "Airplane Structures" Vol. I and II
 NACA TN2661 "A Summary of Diagonal Tension"
 NACA TN3162 "Pressure Distributions on NACA 64A Series
 Airfoil Sections"

WING DRAWINGS:

W-0 Wing Plan
 W-1 Wing Assem. - Complete
 W-2 Leading Edge Assem.
 W-3 48% Beam Assem.
 W-4 65% Beam Assem.
 W-5 Root Rib Assem.
 W-6 Lower Surface Instal.
 W-7 Upper Surface Assem.
 W-8 Wing Tip Assem.
 W-13,14,15 Fitting - Surface Tie
 W-20 thru Former Assem.
 W-45
 W-46,47,48 Fitting - Surface Tie
 W-50 Fuel Tank Edge Angles - Instal.
 W-82,83,84 Fuel Baffles - Instal.
 W-85 Screw Locations - Fuel Cell Cover

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REFERENCES (CONT'D.)WING DRAWINGS:

W-107, Test Panel - Upper
W-108 Test Panel - Lower

EMPENNAGE DRAWINGS:

E-1 Front Spar - Fin
E-2 Fitting - Front Spar - Fin
E-3 Rear Spar - Fin
E-4 Fitting - Rear Spar - Fin
E-5 Forged Billet (Frt. Spar Fitting)
E-6 Forged Billet (Rear Spar Fitting)
E-7 Stabilizer Assem.
E-8 Front Beam Assem. - Stab.
E-9 Fitting Assem. - Stab. Frt. Beam Attach.
E-10 Rear Beam Assem. - Stab.
E-11 Fitting - Stab. Rear Beam Attach.
E-12 Rib Assem. - Stab. Sta. 0
E-13 Panel Assem. - Stab. Inter-Beam Skin
E-14 Rib Assem. - Stab. Canted
E-15 Rib - Stab. Sta. 16
E-19 Fin Assem.
E-20 Basic Dimensions - Fin
E-21 thru E-30 Nose Rib - Stab.
E-31 thru E-36 Rib - Stab.
E-38,39,40 Rib - Stab.
E-41,42,43 Nose Rib - Stab.
E-44 Doubler - Stab. Front Beam Cap

PAGE REF.		PART			CRIT. COND.	REMARKS	MIN. M.S.
NAME	NO.	MAT'L					
WING							
68	UPPER SURF. N.S. 124	W-7	755TL6	+15 FPS GUST	COMP. AND SHEAR STABILITY	+ .15	
70	UPPER SURF. N.S. 115	"	"	"	COMP. + BENDING IN STRINGER	+ .00	
70	UPPER SURF. N.S. 115	"	"	"	COMP., BENDING AND SHEAR IN SKIN	+ .05	
71	LOWER SURF. N.S. 124	W-6	"	"	TENS. AND BENDING IN STRINGER	+ .06	
71	LOWER SURF. N.S. 5R	"	"	"	TENS., BENDING AND SHEAR IN SKIN	+ .06	
72	LOWER SURF. N.S. 180	"	"	-15 FPS GUST	COMP. AND SHEAR STABILITY	+ .20	
73	LOWER SURF. N.S. 190	"	"	"	COMP. AND BENDING IN STRINGER	+ .00	
73	LOWER SURF. N.S. 170	"	"	"	COMP., BENDING AND SHEAR IN SKIN	+ .09	
75	CHARCROSS SPARE N.S. 160 LOWER	"	"	+15 FPS GUST	TENS. AND SHEAR IN NET SECTION	+ .22	
77	CHARCROSS SPARE N.S. 300 LOWER	"	"	+30 FPS GUST	TENS. AND SHEAR ON NET SECTION	+ .61	
78	SPANNING SPARE UPPER JOINT. 154C	W-7	"	"	ATTACHMENT BEARING	+ .36	
82	WING-FUSE JOINT UPPER BOLTS	MS20003	160,000 PSI STEEL	-15 FPS GUST	TENSION ON 1/2" BOLTS	+ .14	
83	WING-FUSE JOINT UPPER	W-5	755TL6	+15 FPS GUST	STRINGER ATTACHMENT BEARING	+ .07	
83	WING-FUSE JOINT LOWER BOLTS	MS20010	160,000 PSI STEEL	"	TENSION ON 5/8" BOLTS	+ .07	
90	LEADING EDGE N.S. 170	W-2	755TL6	+30 FPS GUST	SHEAR AND COMP. ON NOSE	+ .29	
92	LEADING EDGE N.S. 180	"	"	"	COMP. AND BENDING IN STRINGER	+ .16	
93	LEADING EDGE N.S. 170	"	"	"	BEARING ON UPPER ATTACH. TO 15% CAP	+ .02	
101	48% BEAM N.S. 175	W-3	"	+15 FPS GUST	COMP. AND BENDING ON STIFF	+ .01	

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PAGE REF.		PART			CRIT. COND.	REMARKS	MIN. M.S.
	NAME	NO.	MAT'L				
	<u>STABILIZER</u>						
116	FRONT BEARING FITTING	E-1	75STG	DESIGN AND BLD.	COMP. AND SHEAR (STATIC TEST)	+ .23	
120	FRONT BEARING FITTING	E-4	"	81000 PSI + YAW	SHEAR OUTSIDE OF FIN ATTACH.	+ .08	
121	FRONT ATTACH. BOLT - FIN	MS20004	160,000 PSI STEEL	YAW	SHEAR IN 1/2" BOLT	+ .29	
121	FRONT ATTACH. BOLT - FIN	MS20004	"	YAW	TENSION IN 3/8" BOLT	+ .70	
124	REAR BEARING FITTING	E-11	75STG	YAW	SHEAR OUTSIDE OF FIN ATTACH.	+ .38	
124	REAR ATTACH. BOLT - FIN	MS20004	160,000 PSI STEEL	YAW	TENSION IN 3/16" BOLT	+ .36	
124	REAR ATTACH. BOLT - FIN	MS20007	"	YAW	TENSION IN 3/16" BOLT	+ .03	
	<u>FIN</u>						
134	FRONT BEARING FITTING	E-1	75STG	YAW	COMP. IN CAP	+ .04	
137	FRONT BEARING FITTING	E-2	160,000 PSI STEEL	YAW	COMBINED STRESS ON LUG BASE	+ .19	
138	REAR BEARING FITTING	E-3	75STG	YAW	TENS. ON CAP NET SECTION	+ .38	
140	REAR BEARING FITTING	E-4	160,000 PSI STEEL	YAW	BENDING IN FITTING BEARING	+ .07	
142	BOX SKIN	E-17	75STG	YAW	BEARING OF ATTACHMENTS	+ .02	

FORM 361E

PREPARED

CHECKED

APPROVED

2-27-56

CALIFORNIA DIVISION

TITLE:

WING PENNINAGE ANALYSIS

MINIMUM MARGINS OF SAFETY

PAGE

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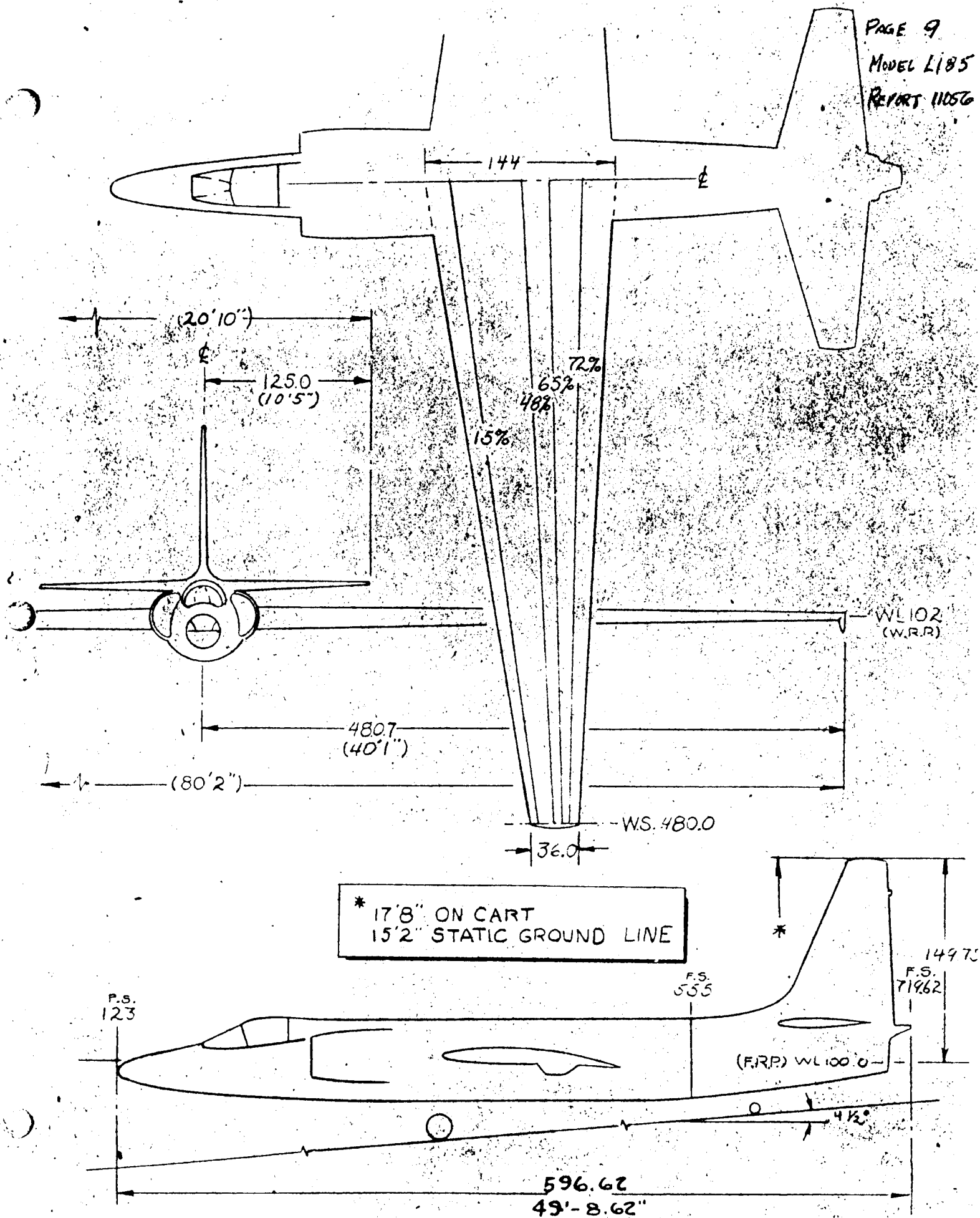
MODEL

L185

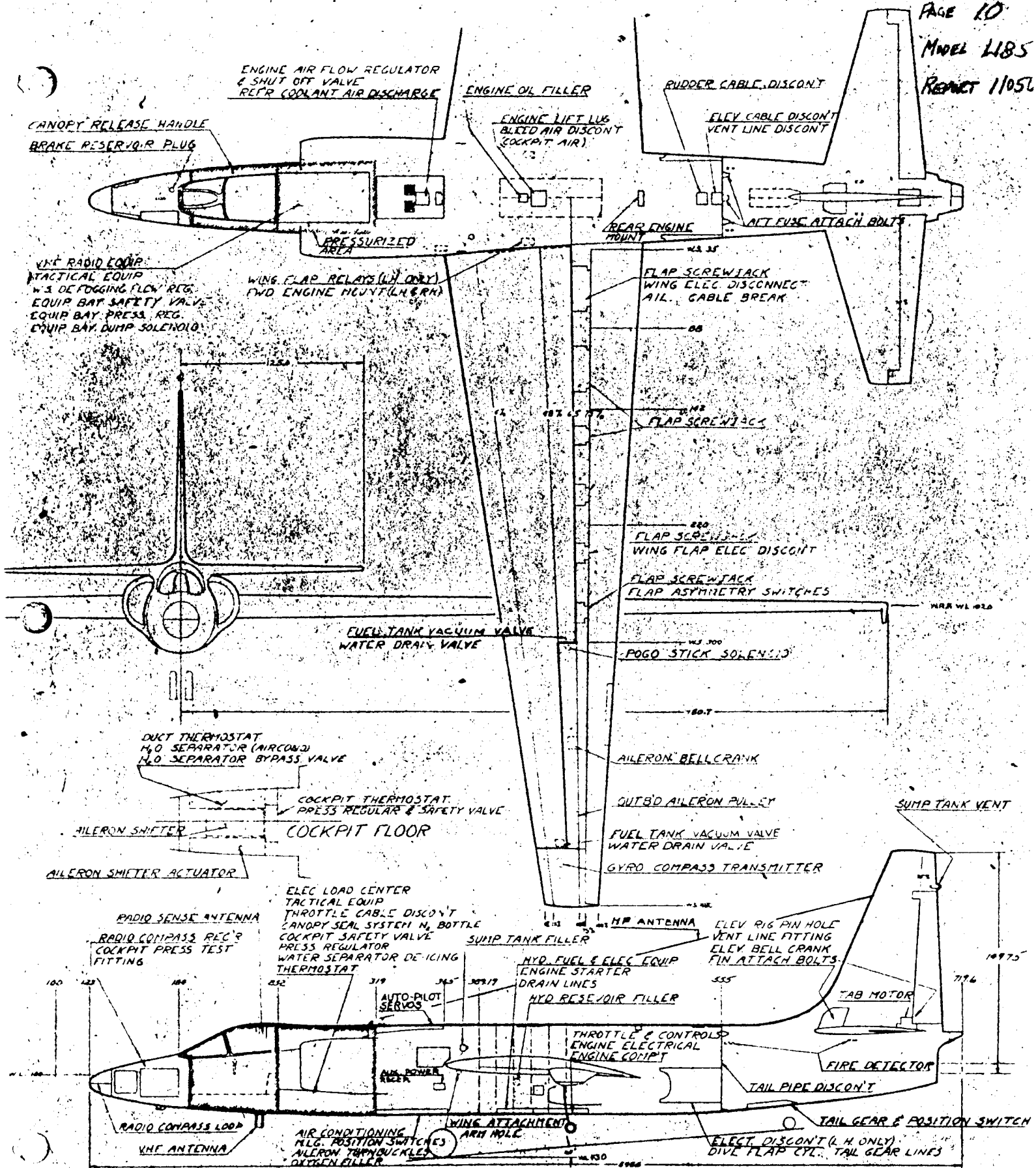
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MODEL 1185
REFUGEE 1105L



BASIC DIMENSIONS GENERAL INFORMATION

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Approved			WING			
				Model	L185	
				Report No.	11056	

DESCRIPTION OF STRUCTURE

THE PRIMARY WING BOX STRUCTURE LIES BETWEEN THE LEADING EDGE AND THE 65% CHORD BEAM AND EXTENDS FROM THE WING-FUSELAGE MATING PLANE (WING STATION 36) TO THE WING TIP JOINT (WING STATION 440). BENDING MATERIAL IS DISTRIBUTED OVER THE BOX SURFACES AND CONSISTS OF 75ST6 EXTRUDED STRINGERS AND 75ST6 ALCLAD SKIN. BEAM SHEAR IS CARRIED BY THE LEADING EDGE AND CONVENTIONAL PARTIAL TENSION FIELD BEAMS AT 48 AND 65% CHORD. A TYPICAL SECTION SHOWING THE DISTRIBUTION OF STRUCTURE IS SHOWN ON PAGE 24.

FUEL TANKS ARE OF THE INTEGRAL TYPE. THE MAIN TANK FILLS THE BOX BETWEEN THE LEADING EDGE AND THE 48% BEAM AND EXTENDS FROM STATION 36 TO STATION 440 WITH A CAPACITY OF APPROXIMATELY 480 GALLONS PER WING. THE AUXILIARY TANK FILLS THE BOX BETWEEN THE 48 AND 65% BEAMS AND EXTENDS FROM STATION 36 TO STATION 300 WITH A CAPACITY OF APPROXIMATELY 150 GALLONS PER WING. IN ORDER TO ALLOW FOR SEALING THE STRUCTURE, THE ENTIRE UPPER SURFACES ARE REMOVABLE ALONG THE SPAR CAPS AND END RIBS. AN EXTRUDED RUBBER STRIP SEALS THE PANELS AROUND THEIR EDGES.

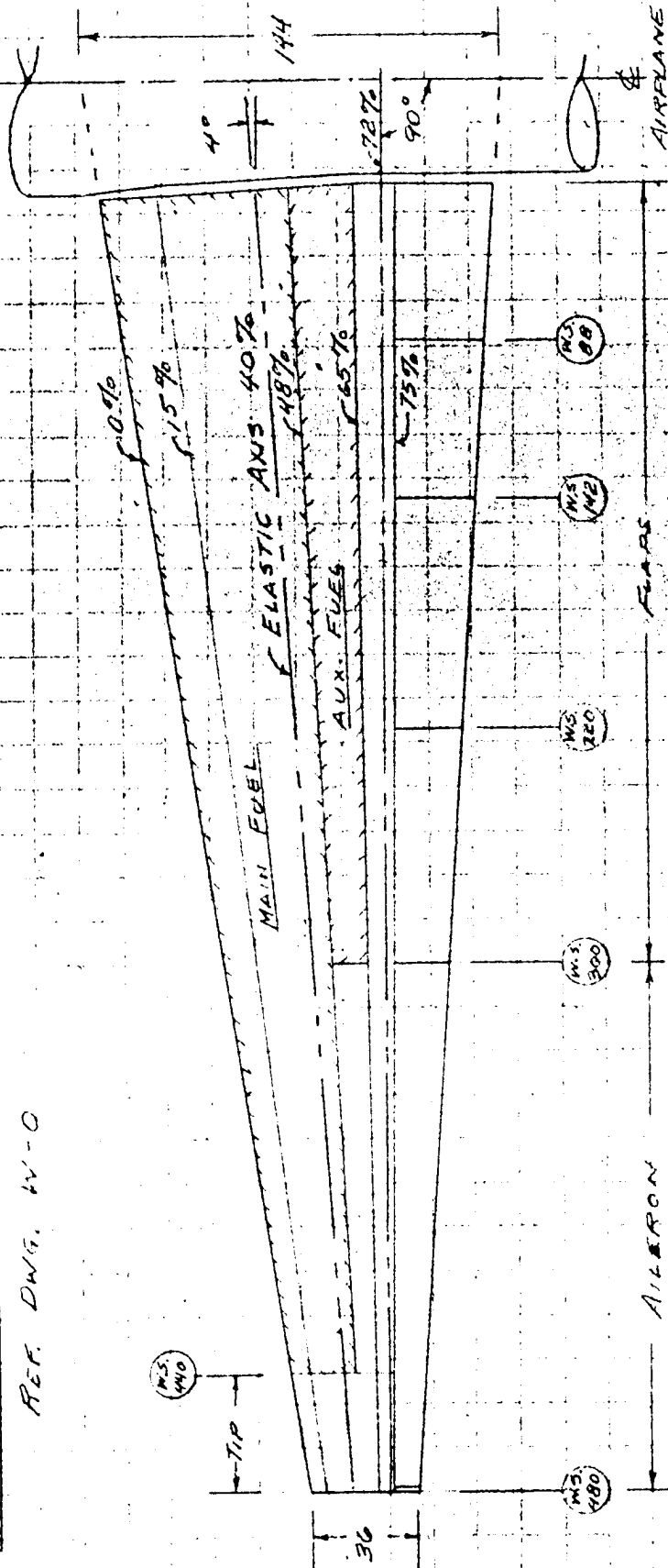
RIB ACTION IS OBTAINED BY MEANS OF UPPER AND LOWER FORMERS RIVETED TO THE SURFACES AND CONNECTED TOGETHER BY SHEAR AND AXIAL LOAD CARRYING FITTINGS USING A THROUGH BOLT FROM THE UPPER SURFACE.

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GEOMETRY

WING PLAN (SCALE 1" = 60")

REF. DWG. W-0



WING DATA

AREA - 600 FT.²

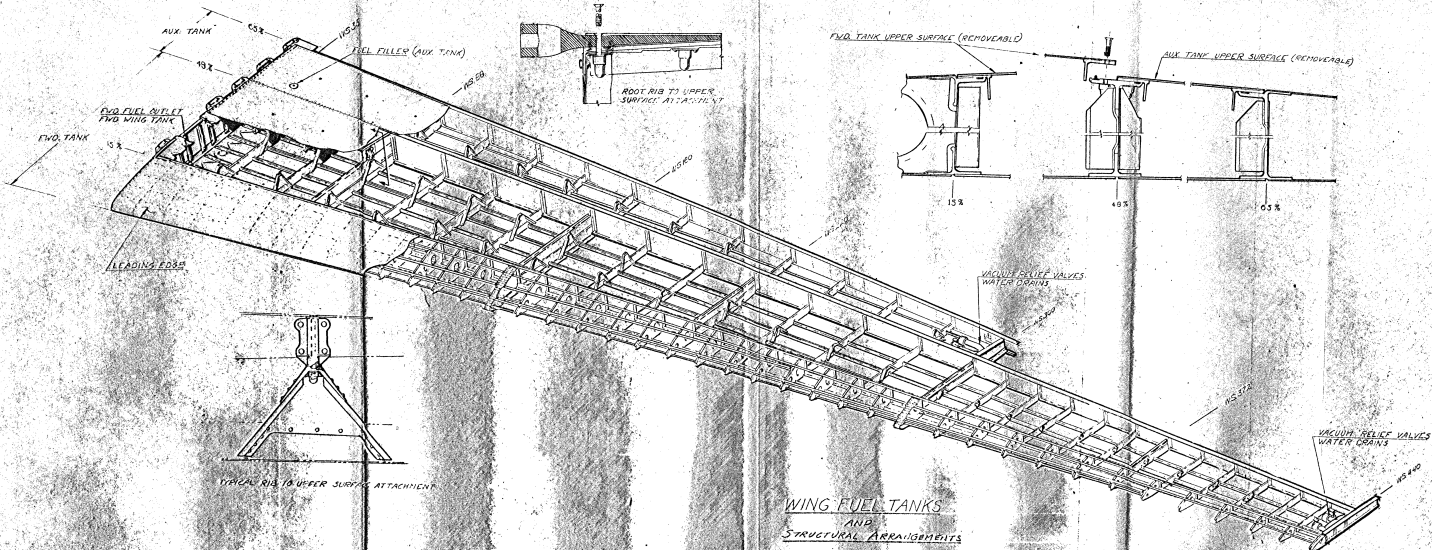
SPAN - 80 FT

ROOT SECTION - 63A404, $\frac{1}{4}$ - 09, $\frac{1}{4}$ - 12 FT.

TIP SECTION - 63A404, $\frac{1}{4}$ - 06, $\frac{1}{4}$ - 3 FT.

ASPECT RATIO - 10.67

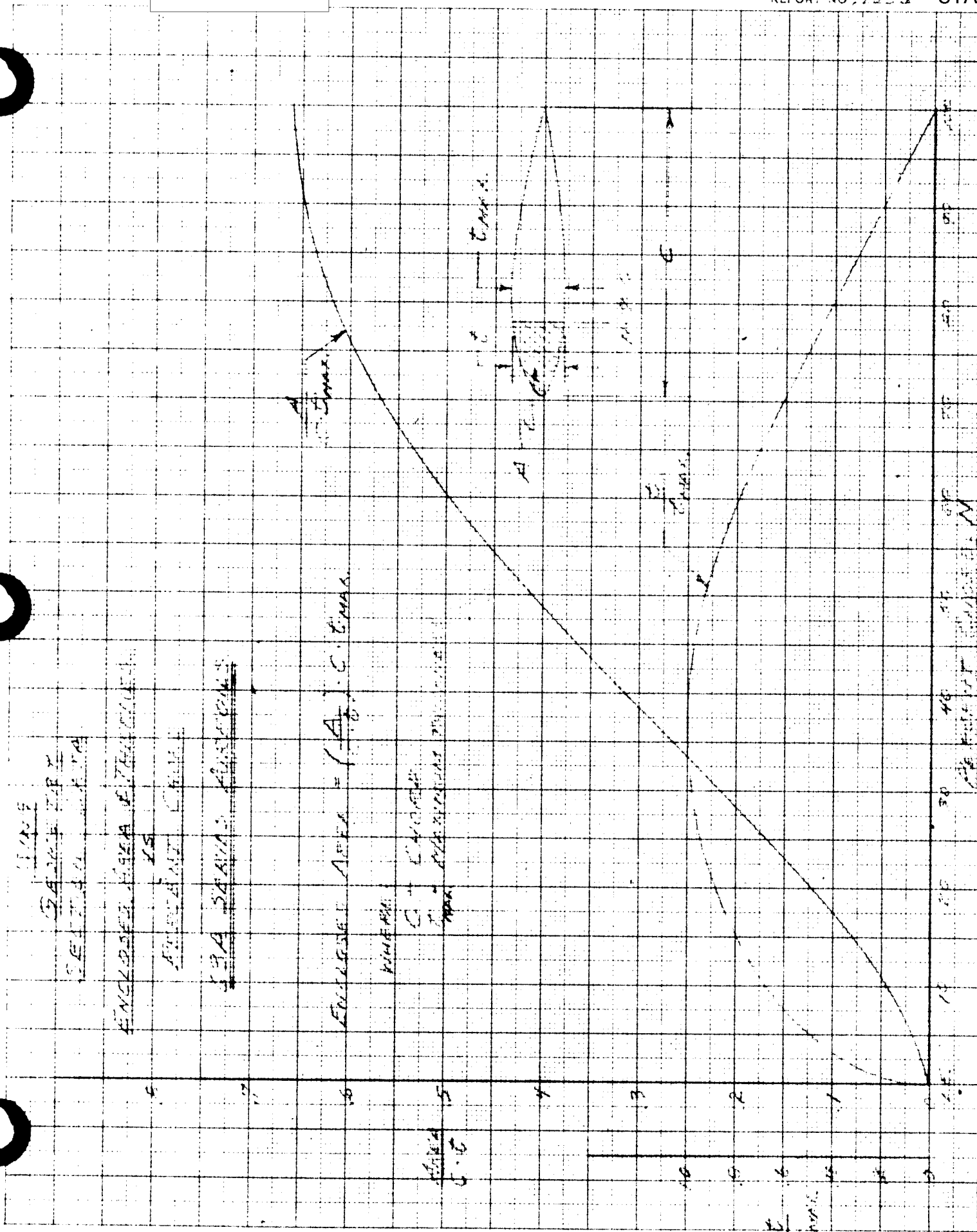
M.A.C. - 8.4 FT @ WING STATION 192



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 DATE: [REDACTED]
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DATE
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LOCKHEED AIRCRAFT CORPORATION

MODEL
REPORT NO.

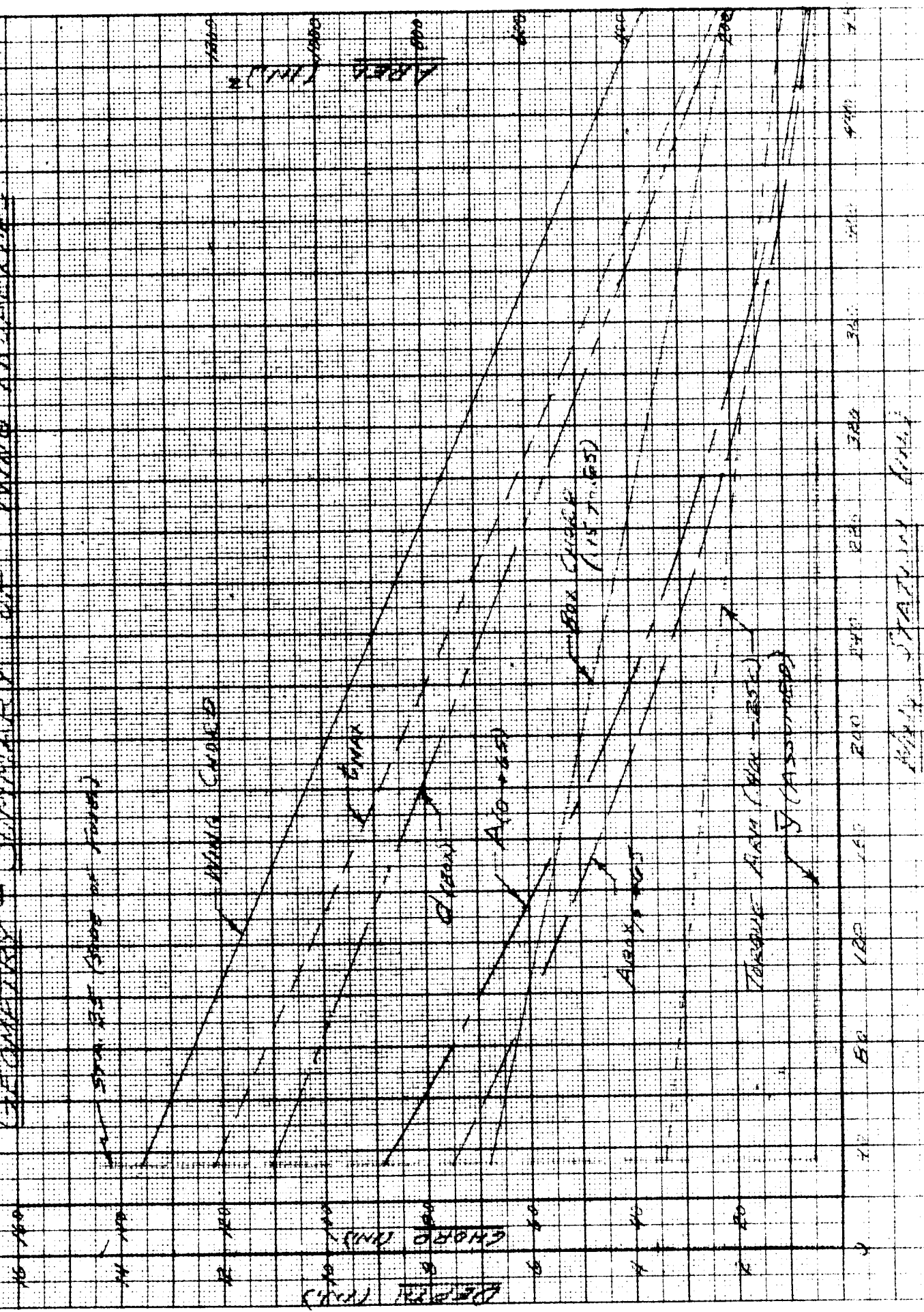
REPRODUCED BY THE AIR FORCE RESEARCH AND DEVELOPMENT COMMAND, RANDOLPH AFB, TEXAS

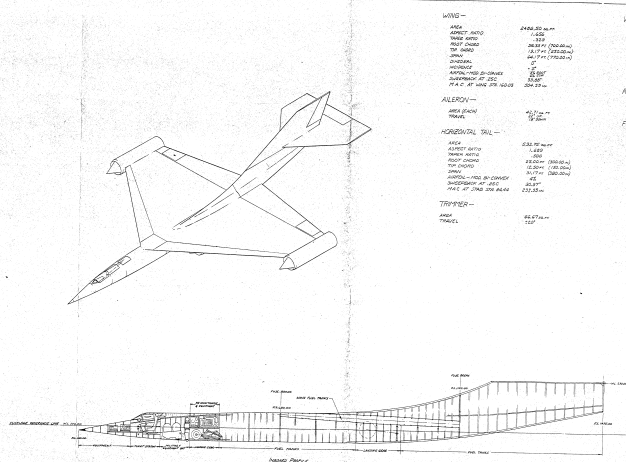
TECHNICAL

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FORM 100-100

GEOMETRY - SIMILARITY OF WING PROFILES





WAYS-

AREA	2450.50 sq.m
ADJECT. RATIO	1.656
THICK. GYRO	329
ROST. CHORD	26.31 ft (790.60 mm)
TOP. GYRO	13.17 ft (402.00 mm)
JAPAN	64.77 ft (1972.00 mm)
CIRCULAR	3"
INCHES	3"
APPROX. HIG. IN. GYRO	13.66 ft
SUBSTRATE AT 250	55.10
PLA. AT. WAVE. ST. 10.00	75.00

ALL EPOCHS—

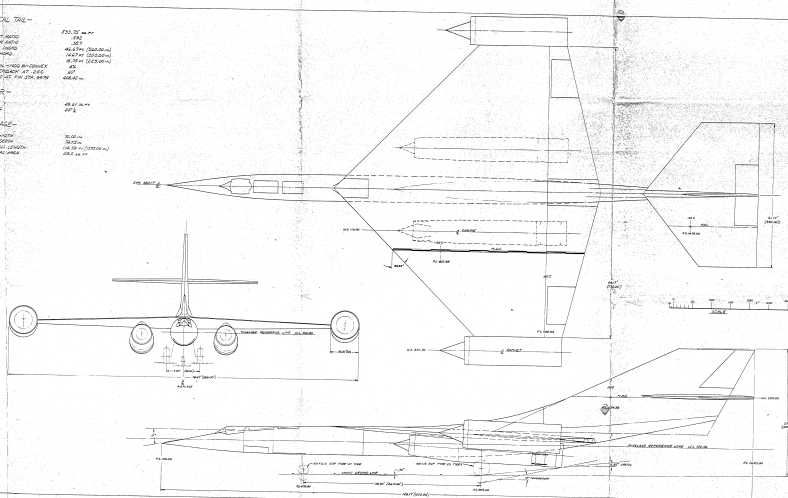
AREA (ACRES)
TRAFFIC

HORIZONTAL TAIL —

AREA 531.75 ac
ASPECT RATIO 1:250
TRAFFIC RATIO 500
ROOF CHORD 25.000' (100.00 ft)
TOWER CHORD 12.500' (50.00 ft)
TOWER 31.75' (125.00 ft)
HORIZONTAL TAIL 45'
HORIZONTAL TAIL 25.75'
HORIZONTAL TAIL 25.75'

TERMS—

ANZA 66.67 20.00



1. *Staphylococcus aureus* 2. *Staphylococcus aureus*

VERTICAL TAIL-

AREA	538.25 sq ft
WING AREA	532
TAPER AREA	507
ROOT CHORD	46.67 ft (142.00 in)
TIP CHORD	14.67 ft (44.80 in)
SPAN	87.35 ft (265.90 in)
WING - WING B - CHORD	45
WING - WING AT 250	67
WING - WING AT 275	68.62 in

READER-

AREA	AREA
TRAIL	48.61 sq. ft
	207 ft
FLYING AREA	
TRAIL WIDTH	30.00 in
TRAIL DEPTH	76.73 in
TRAIL LENGTH	104.50 in (10.375 m)
TRAIL AREA	230.00 sq ft

1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 2560, 2561, 2562, 2563, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2577, 2578, 2579, 2580, 2581, 2582, 2583, 2584, 2585, 2586, 2587, 2588, 2589, 2590, 2591, 2592, 2593, 2594, 2595, 2596, 2597, 2598, 2599, 2600, 2601, 2602, 2603, 2604, 2605, 2606, 2607, 2608, 2609, 2610, 2611, 2612, 2613, 2614, 2615, 2616, 2617, 2618, 2619, 2620, 2621, 2622, 2623, 2624, 2625, 2626, 2627, 2628, 2629, 2630, 2631, 2632, 2633, 2634, 2635, 2636, 2637, 2638, 2639, 2640, 2641, 2642, 2643, 2644, 2645, 2646, 2647, 2648, 2649, 2650, 2651, 2652, 2653, 2654, 2655, 2656, 2657, 2658, 2659, 2660, 2661, 2662, 2663, 2664, 2665, 2666, 2667, 2668, 2669, 2670, 2671, 2672, 2673, 2674, 2675, 2676, 2677, 2678, 2679, 26

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DESIGN LOADS

DESIGN LOADS INCLUDING BEAM BENDING MOMENT, BEAM SHEAR AND TORSION ABOUT THE ELASTIC AXIS (40% CHORD) ARE SHOWN FOR CRITICAL CONDITIONS IN THE TABLE ON THE FOLLOWING PAGE. CONDITIONS SHOWN ARE ENVELOPE CURVES SINCE CRITICAL LOADS FOR ANY ONE PORTION OF THE WING ARE A FUNCTION OF GROSS WEIGHT.

CRITICAL CONDITIONS

POSITIVE GUST (+30FPS) AT $V_C = 150$ KNOTS
IS CRITICAL FOR UPBENDING FROM STATION 180 OUTBOARD AND PRODUCES MAXIMUM SHEAR IN THE LEADING EDGE.

POSITIVE GUST (+15FPS) AT $V_D = 260$ KNOTS
IS CRITICAL FOR UP BENDING INBOARD OF STATION 180 AND PRODUCES MAXIMUM SHEAR ON THE 48% AND 65% BEAMS IN THIS REGION.

NEGATIVE GUST (-15FPS) AT $V_D = 260$ KNOTS
IS CRITICAL FOR DOWN BENDING, PRODUCING MAXIMUM COMPRESSION IN THE LOWER SURFACE

POSITIVE ROLLING MANEUVER IS CRITICAL FOR MAXIMUM SHEAR IN THE OUTBOARD PORTIONS OF THE 48% AND 65% BEAMS.

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				WING				L185		11056			
DESIGN LOADS - ULTIMATE (REF. LR 11055, Pgs. 223 - 731)													
COMPARISON OF CRITICAL CONDITIONS (TRACTION, MT ABOUT 40% CHOSED)													
Wing STA.	+30 fps GUST			+15 fps GUST			LOG - TIP SKID (RATIONAL COND.)			-15 fps GUST			MT $\times 10^{-6}$
	SE $\times 10^{-3}$	Mx $\times 10^{-6}$	My $\times 10^{-6}$	SE $\times 10^{-3}$	Mx $\times 10^{-6}$	My $\times 10^{-6}$	SE $\times 10^{-3}$	Mx $\times 10^{-6}$	My $\times 10^{-6}$	SE $\times 10^{-3}$	Mx $\times 10^{-6}$	My $\times 10^{-6}$	
36	+19.4	+4.125	+231	+22.9	+4450	-174	-	-	-	-7.50	-2480	-351	
70	19.3	3.520	240	22.8	3.680	-072	-	-	-	-9.45	-2.210	-309	
106	19.2	2.900	236	21.6	3.000	-030	-	-	-	-9.45	-1.890	-258	
180	14.5	1.740	174	15.8	1.740	+012	-	-	-	-8.14	-1.230	-141	
240	10.6	1.050	126	10.5	1.000	.045	-	-	-	-6.90	-780	-065	
312	6.3	.465	072	6.2	.450	.052	-	-	-	-4.95	-360	-008	
360	4.1	.210	041	3.8	.210	.024	+1.50	+1.80	-012	-3.15	-160	-003	
430	+1.3	+030	+008	+1.2	+030	+005	+1.50	+075	-012	-1.00	-020	0	

STAT

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DESIGN LOADS - ULTIMATE (CONT'D) (REF. L.R. 11455, Pgs. 7.23-7.31)

COMPARISON OF CRITICAL CONDITIONS (TORSION, MT ABOUT 40% CHORD)

STA.	+ Roll (Max. SHEAR)				+ Roll (Max. TORSION)				- Roll			
	S _z x 10 ⁻³	M _x x 10 ⁻⁶	M _T x 10 ⁻⁶	S _z x 10 ⁻³	M _x x 10 ⁻⁶	M _T x 10 ⁻⁶	S _z x 10 ⁻³	M _x x 10 ⁻⁶	M _T x 10 ⁻⁶	S _z x 10 ⁻³	M _x x 10 ⁻⁶	M _T x 10 ⁻⁶
36	+1425	+2.670	-250	+1390	+2.430	-308	-	-	-	-	-	-
70	13.40	2.340	-195	12.10	1.950	-243	-	-	-	-	-	-
106	12.20	2.000	-150	10.50	1.545	-200	-	-	-	-	-	-
150	9.90	1.330	-090	7.30	.875	-133	-	-	-	-	-	-
190	8.10	.855	-066	4.90	500	-102	-	-	-	-	-	-
212	5.85	405	-045	3.15	.195	-070	-255	-180	+074	-	-	-
260	3.80	172	-027	1.92	.080	-043	-1.65	-076	.042	-	-	-
430	+1.05	+0.30	-009	+45	+0.20	-013	-45	-015	+0.12	-	-	-

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INTERNAL LOADSDISCUSSION

THE FOLLOWING SECTION PRESENTS THE SECTION PROPERTIES AND INTERNAL LOADS FOR THE WING BOX STRUCTURE. ANALYSIS STATIONS USED ARE:

STATION 36 (WING TO FUSELAGE JOINT)
STATION 70
STATION 180
STATION 312
STATION 430

CONVENTIONAL UNIT BEAM TAB FORMS ARE USED TO OBTAIN SECTION PROPERTIES, AXIAL LOADS AND BENDING STRESSES. IN ORDER TO OBTAIN WEB SHEAR FLOWS, A TWO CELL ANALYSIS IS MADE USING Q/P SHEARS OVER A UNIT LENGTH OF ONE INCH AND USING THE EXTERNAL APPLIED BEAM SHEAR CORRECTED FOR BOX TAPER. CHORD LOADS ARE NEGLIGIBLE.

BEAM SHEAR TAPER CORRECTION

THE EXTERNAL BEAM SHEAR, S_z , IS CORRECTED TO NET SHEAR, S_z' , FOR EACH CONDITION AS FOLLOWS:

$$S_z' = S_z - \Delta S_z$$

WHERE,

$$\Delta S_z = \frac{M_x}{d_e} \tan \theta$$

AND

d_e = EFFECTIVE DEPTH OF BOX,

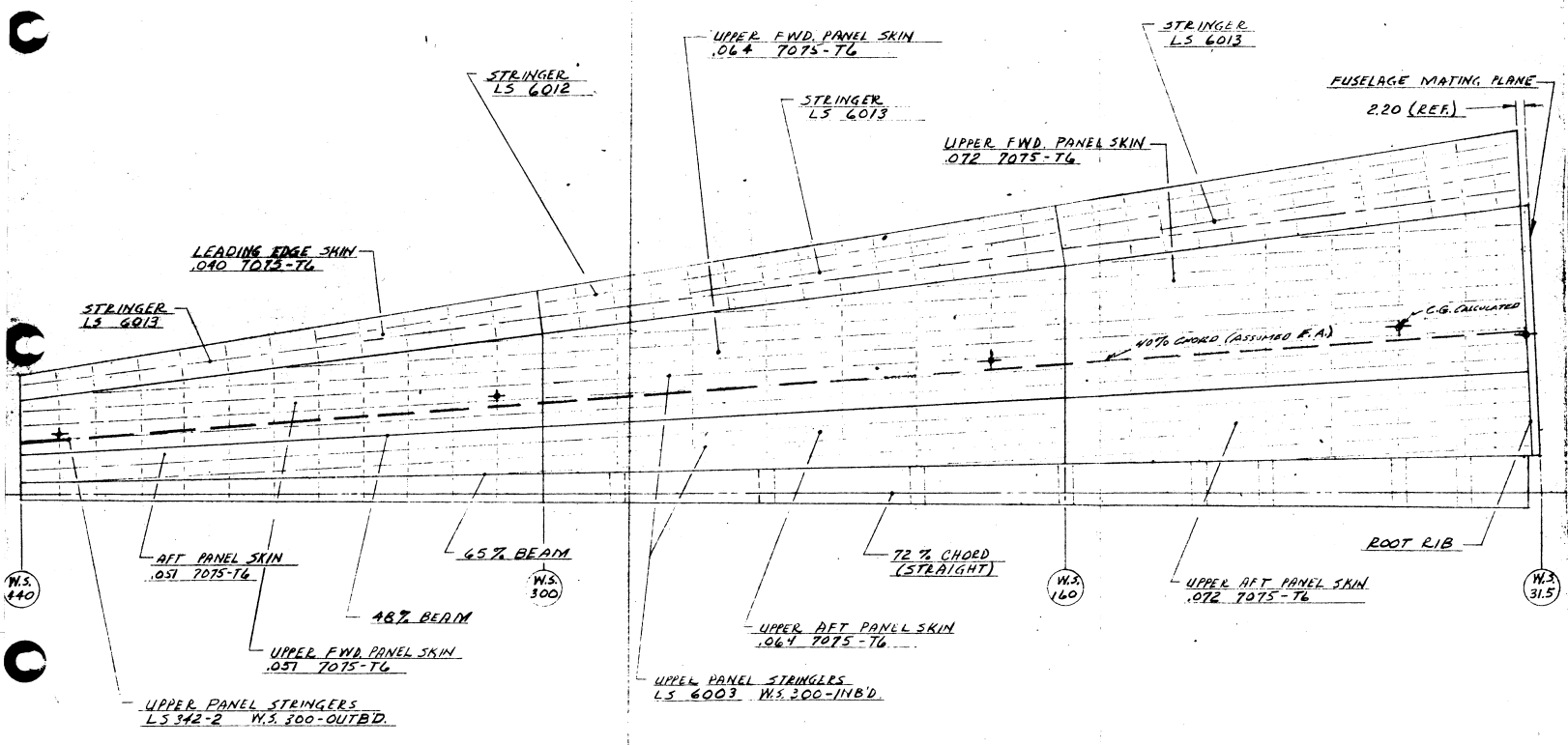
$\tan \theta$ = TANGENT OF THE ANGLE BETWEEN UPPER AND LOWER SURFACES $\cong .02$.

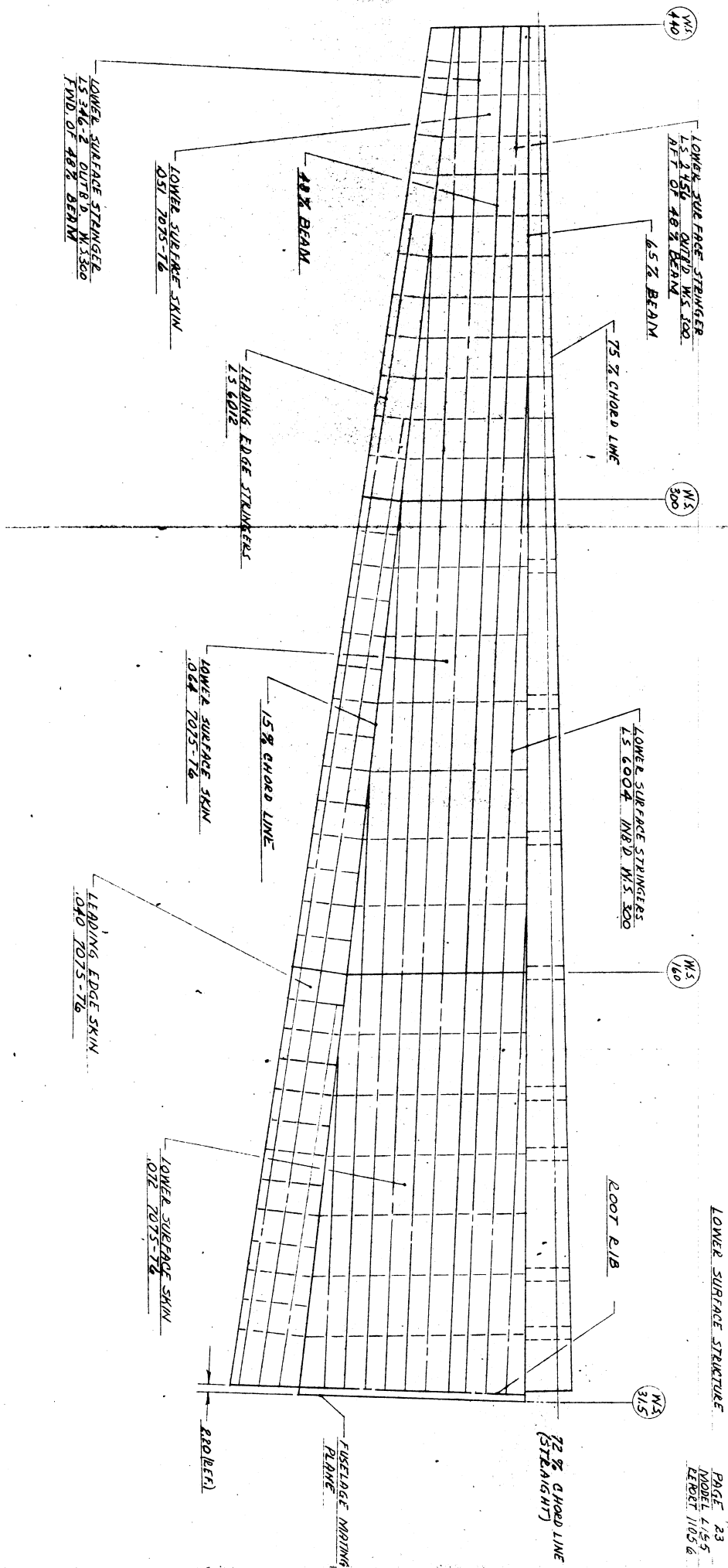
Prepared		DATE		LOCKHEED AIRCRAFT CORP.										Page	TEMP.	PERM.
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UPPER SURFACE STRUCTURE

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MODEL L155
REPORT NO. 11056





LOWER SURFACE STRUCTURE

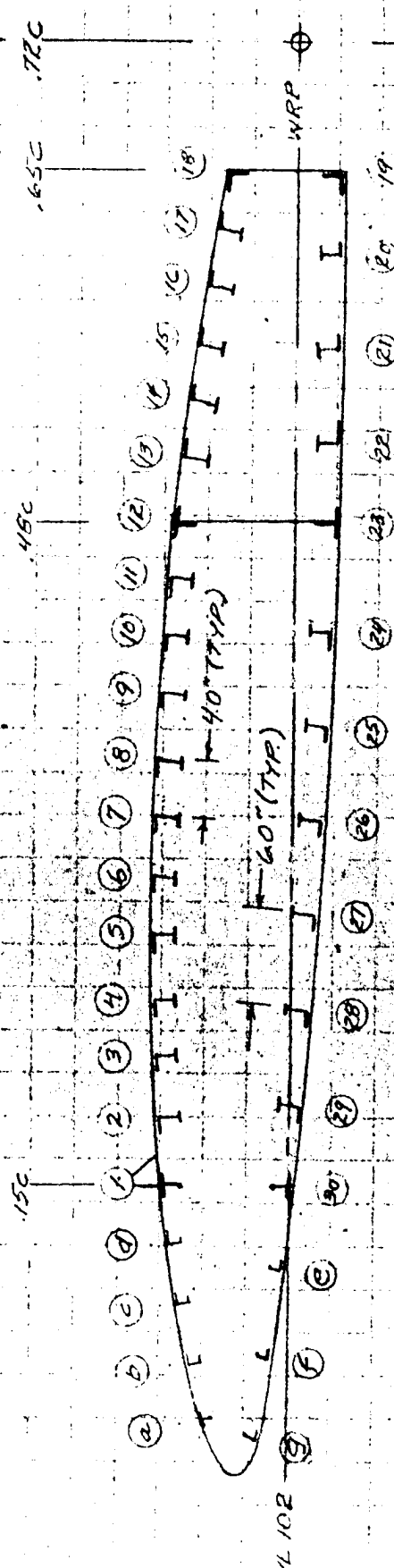
PAGE 23
MODEL 1155
LEFOT 11056

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SECTION PROPERTIES

TYPICAL FLANGE AND WEB DESIGNATIONS

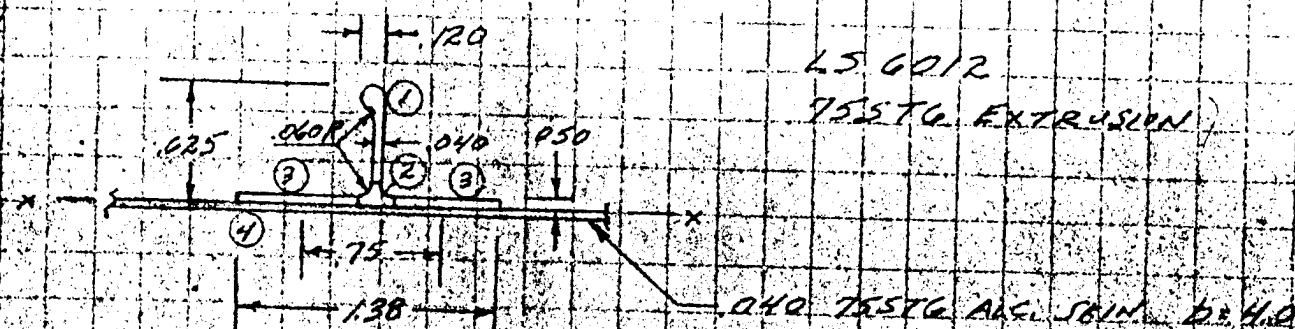
F5.
402.3



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SECTION PROPERTIES

UPPER SURFACE, STRGR (A)



N	AREA	1/2 OR R/2	F_{Cn}	F_{Cn}
1	.0279	12.9	46500	1296
2	.0159	1.8	81000	1288
3	.0570	11.4	20900	1190
Σ	.1008			3774

$$F_{Cn} = \frac{3774}{.1008} = 37400 \text{ PSI (SM45)}$$

$$b_c = (16 \times 2.5 \times .040) + .75 = 2.35 \text{ IN (SMR3)}$$

N	AREA	Y	AY	AY ²	I_o
1	.0279	.4160	.0116	.0048	.0005
2	.0159	.0432	.0007	—	—
3	.0570	.0250	.0014	—	—
4	.0940	-.0200	-.0019	—	—
Σ	.1948	.0605	.0118	.0048	.0005

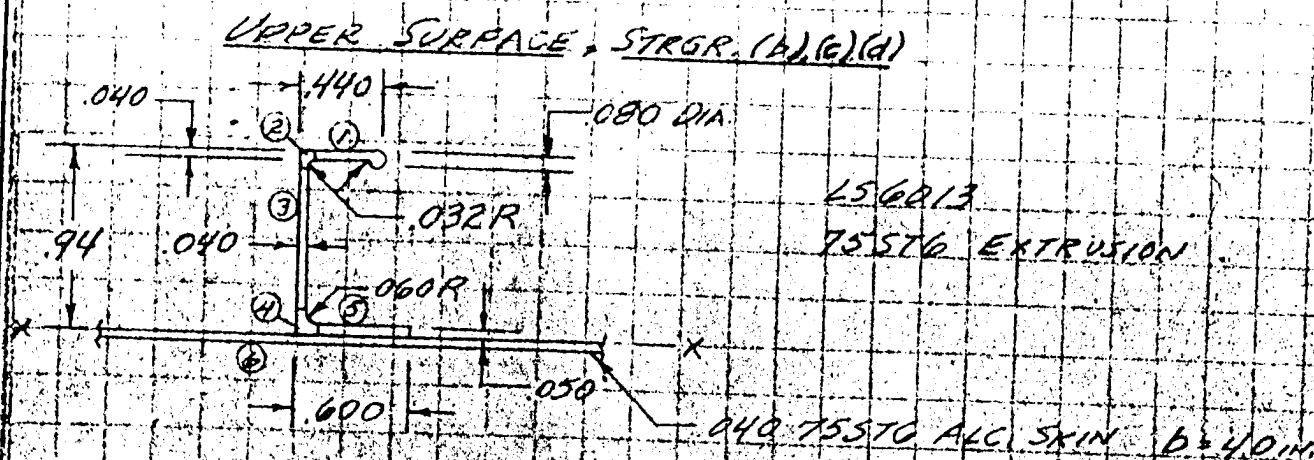
$$I_{NA} = .0053 - .0605(.0118) = .0046 \text{ in.}^4$$

$$P = \sqrt{\frac{.0046}{.1948}} = .154 \text{ in.}$$

$$A_{GROSS} = .1008 + 4 \times .040 = .261 \text{ in.}^2$$

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SECTION PROPERTIES



N	AREA	b/e OR r/e	F _{cen}	P _{cen}
1	.0177	9.2	51000	900
2	.0044	1.3	82500	360
3	.0305	19.1	58000	1770
4	.0079	1.8	81500	640
5	.0250	10.0	23500	590
Σ	.0855			4260

$$F_{cc} = \frac{4260}{.0855} = 49800 \text{ PSI (SM45)}$$

$$b_e = 14 \times 2.5 \times .040 = 1.43 \text{ in. (SMR3)}$$

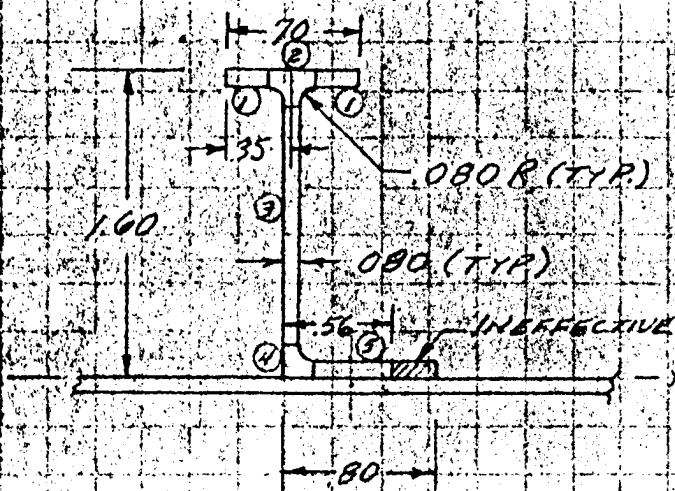
N	AREA	Y	AY	AY ²	I _o
1	.0177	.920	.0163	.0150	—
2	.0044	.900	.0040	.0036	—
3	.0305	.489	.0149	.0073	.0015
4	.0079	.050	.0004	—	—
5	.0250	.025	.0006	—	—
6	.0572	-.020	-.0011	—	—
Σ	.1427	.238	.0351	.0259	.0015

$$I_{NA} = .0274 - .238(.0351) = .0190 \text{ in.}^4$$

$$P = \sqrt{\frac{.0190}{.1427}} = .364 \text{ in.}$$

$$A_{GROSS} = .0855 + 4 \times .040 = .246 \text{ in.}^2$$

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SECTION PROPERTIESUPPER SURFACE, STRGR 2-11, 13-17BASIC STA. 35-300

256003

255TG EXTRUSION

GROSS PROPERTIES:

$A = 240 \text{ IN.}^2$

$I = 105 \text{ IN.}^4$

$\bar{Y} = 78.0 \text{ IN.}$

n	AREA	b/t or R/t	Fccn	Pccn
1	.0368	2.9	65000*	2390
2	.0288	1.5		1870
3	.1023	16.0	67500	6900
4	.0208	1.5	82000	1710
5	.0320	5.0	65000	2080
Σ	.2207			14950

* LATERAL BOWING CUTOFF

$$F_{cc} = \frac{14950}{.2207} = 67500 \text{ PSI (SM45)}$$

SUBSTANTIATED BY PANEL TEST

REF. LR 10751, SEC. 7, PG. 7-9.

n	AREA	Y	AY	AY ²	I _o
1	.0368	1.560	.0574	.0845	—
2	.0288	1.540	.0444	.0685	—
3	.1023	.800	.0819	.0655	.0140
4	.0208	.060	.0012	.0001	—
5	.0320	.040	.0013	.0001	—
Σ	.2207	.842	.1862	.2237	.0140

$$I_b = .2377 - .842(.1862) = .0807 \text{ IN.}^4$$

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SECTION PROPERTIESUPPER SURFACE, STAG 2-11, 13-17STA. 52

L53228-3
75ST6 EXTRUSION

$$A_e = 1.500 \text{ IN.}^2$$

$$I_e = 0.0144 \text{ IN.}^4$$

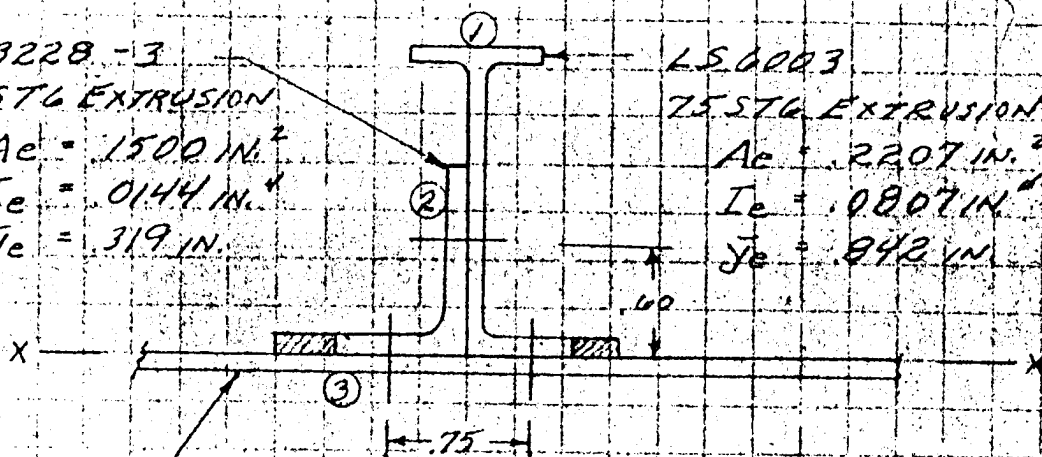
$$\bar{y}_e = 3.19 \text{ IN.}$$

L50003
75ST6 EXTRUSION

$$A_e = 2.207 \text{ IN.}^2$$

$$I_e = 0.0807 \text{ IN.}^4$$

$$\bar{y}_e = 0.842 \text{ IN.}$$



75ST6 ALC. SKIN $b = 4.0 \text{ IN.}$

$$F_{cc} = 67500 \text{ PSI (REF. BASIC, PG. 27)}$$

$$b_e = (10 \times 2.1 \times 0.072) + 0.75 = 2.26 \text{ IN. (SM23)}$$

n	AREA	y	AY	AY ²	I _o
1	2.207	0.842	1.860	1.565	0.0807
2	1.500	3.19	4.785	15.33	0.0144
3	1.626	-0.36	-0.586	0.222	—
Σ	5.333	4.28	22.81	17.20	0.0951

$$I_e = 0.2671 - 4.28(22.81) = 0.1696 \text{ IN.}^4$$

$$r = \sqrt{\frac{0.1696}{5.333}} = 0.564 \text{ IN.}$$

$$A_{\text{GROSS}} = 0.240 + 1.778 + 4 \times 0.072 = 1.06 \text{ IN.}^2$$

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SECTION PROPERTIES

UPPER SURFACE, STRG R-11, 13-17

STA 70-106

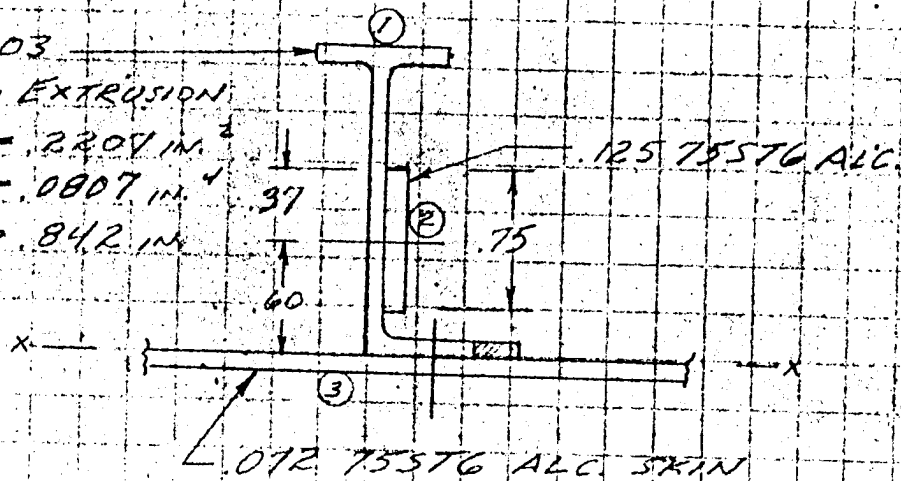
L56003

755TG EXTRUSION

$$A_e = .2207 \text{ in.}^2$$

$$I_e = .0807 \text{ in.}^4$$

$$I_e = .842 \text{ in.}^4$$



$$F_{cc} = 67500 \text{ PSI (REF. BASIC, PG. 27)}$$

$$b_e = 10 \times 2.1 \times .072 = 1.51 \text{ in. (SMR3)}$$

n	AREA	Y	A _y	A _y ²	I _o
1	.2207	.842	.1860	.1565	.0807
2	.0937	.600	.0562	.0337	.0044
3	.1087	-.036	-.0039	.0001	—
Σ	.4231	.563	.2383	.1903	.0851

$$I_e = 2754 - .563(2383) = .1410 \text{ in.}^4$$

$$r = \sqrt{\frac{.1410}{.4231}} = .576 \text{ in.}$$

$$A_{\text{GROSS}} = .240 + .094 + 4 \times .072 = .622 \text{ in.}^2$$

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SECTION PROPERTIESUPPER SURFACE, STRIP 2-1, 13-17STA. 106-160

LS6003 BASIC AND .072 755TG ALG. SKIN

 $b = 4.0 \text{ in.}$ $F_{cc} = 67500 \text{ PSI}$ (REF. BASIC, PG. 27.) $b_e = 10 \times 2.1 \times .072 = 1.512 \text{ in.}$ (SM 23)

n	AREA	Y	AY	AY ²	I _o
1	.2207	.842	.1860	.1565	.0807
2	.1087	-.036	-.0039	.0001	—
Σ	.3294	.553	.1821	.1566	.0807

$$I_e = .2373 - .553(.1821) = .130 \text{ in.}^4$$

$$\rho = \sqrt{\frac{I_e}{.3294}} = .629 \text{ in.}$$

$$A_{\text{GROSS}} = .240 + 4 \times .072 = .528 \text{ in.}^2$$

STA. 160-300

LS6003 BASIC AND .064 755TG ALG. SKIN

 $b = 4.0 \text{ in.}$ $F_{cc} = 67500 \text{ PSI}$ (REF. BASIC, PG. 27.) $b_e = 10 \times 2.2 \times .064 = 1.41 \text{ in.}$ (SM 23)

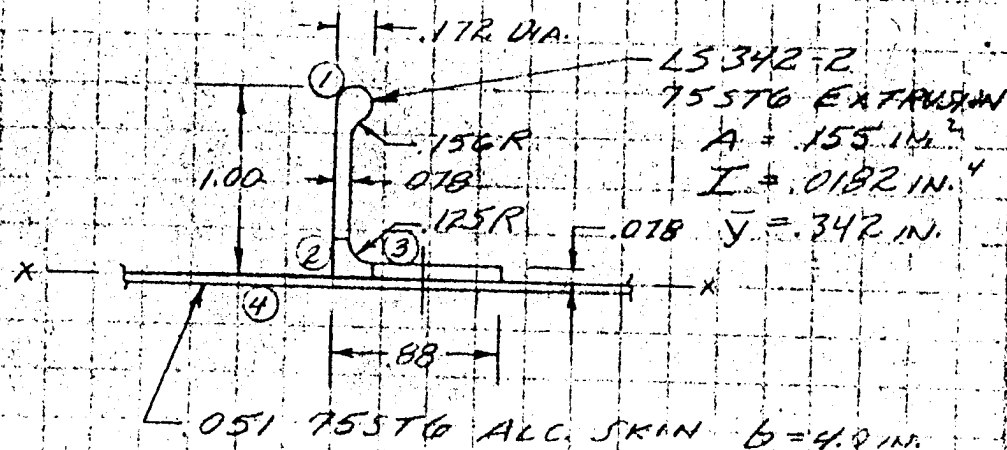
n	AREA	Y	AY	AY ²	I _o
1	.2207	.842	.1860	.1565	.0807
2	.0903	-.032	-.0029	.0001	—
Σ	.3110	.589	.1831	.1566	.0807

$$I_e = .2373 - .589(.1831) = .1294 \text{ in.}^4$$

$$\rho = \sqrt{\frac{I_e}{.3110}} = .645 \text{ in.}$$

$$A_{\text{GROSS}} = .240 + 4 \times .064 = .496 \text{ in.}^2$$

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SECTION PROPERTIESUPPER SURFACE, STG. 2-11, 13-17STA. 300-440

N	AREA	b/t or R/t	F _{CON}	P _{CON}
1	.073	10.2	49000	3580
2	.029	1.6	82000	2380
3	.053	8.7	29000	1540
Σ	.155			7500

$$F_{CL} = \frac{7500}{.155} = 48000 \text{ PSI (SM45)}$$

$$b_e = 14.3 \times .57 \times .051 = 1.7 \text{ in. (SM25)}$$

N	AREA	Y	AY	AY ²	I ₀
1	.155	.342	.0530	.0181	.0182
2					
3					
4	.087	-.025	-.0022	.0001	—
Σ	.242	.210	.0508	.0182	.0182

$$I = .0364 - .210(.0508) = .0257 \text{ in.}^4$$

$$S = \sqrt{\frac{.0257}{.342}} = .325 \text{ in.}$$

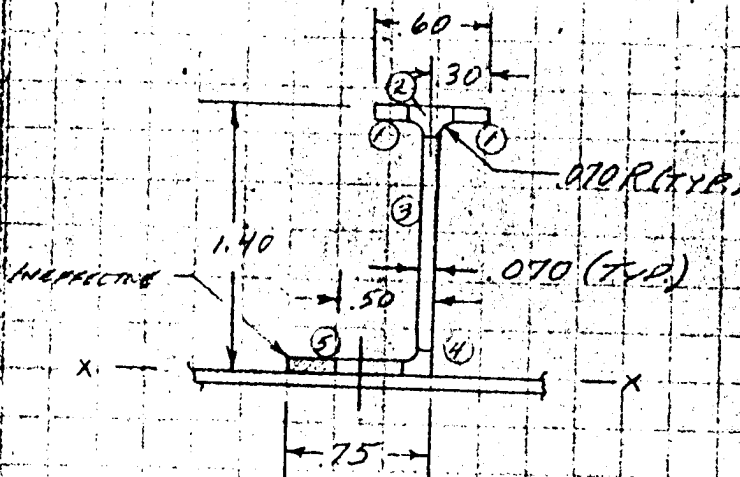
$$A_{GROSS} = .155 + 4(.051) = .359 \text{ in.}^2$$

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SECTION PROPERTIES

LOWER SURFACE, STRGS 20-22, 24-28

BASIC, STA 35-300



456004

755TG EXTRUSION

A - 189, n. 2

I = 055 in. ⁴

$$\bar{y} = 666 \text{ m.}$$

n	AREA	$\frac{b}{h}$ or $\frac{R}{h}$	F_{CL}	F_{CN}
1	.0275	2.8	} 62000*	3040
2	.0217	1.5		
3	.0794	16.0		
4	.0157		67500	5290
5	.0245	5.0	82000	1290
Σ	1676		65000	1590
				11210

* LATERAL BOWING CUTOFF

$$F_{cc} = \frac{11210}{1676} = 67000 \text{ PSI} \quad (5M45)$$

Y	AREA	Y	AY	AY ²	I ₀
1	.0273	1.365	.0373	.0510	—
2	.0217	1.350	.0293	.0396	—
3	.0784	.700	.0549	.0384	.0082
4	.0157	.650	.0008	—	—
5	.0245	.035	.0009	—	—
Σ	.1676	.735	.1232	.1290	.0082

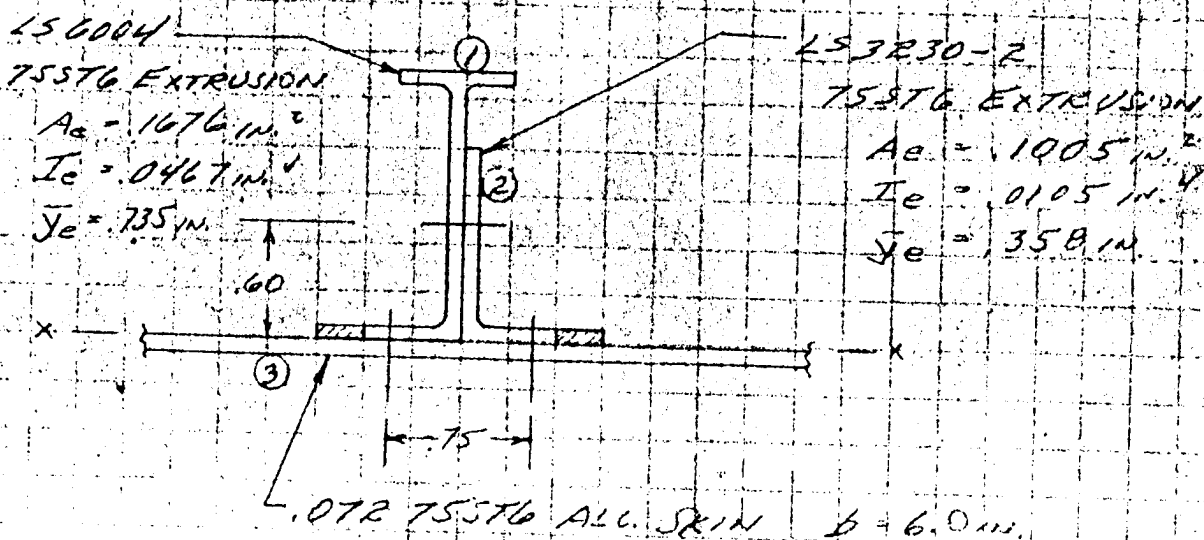
$$I_c = .1372 - .135(1.1252) = .0467 \text{ in.}^4$$

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SECTION PROPERTIES

LOWER SURFACE STRIP, 20-22, 24-29

STA. 52



$$F_{cu} = 66000 \text{ PSI} \quad (\text{REF. BASIC, PG. 32})$$

$$b_e = (10 \times 2.4 \times .072) + .75 = 2.48 \text{ in.} \quad (\text{S1123})$$

n	AREA	y	AY	Ay ²	I _o
1	.1676	.735	.1230	.0904	.0467
2	.1005	.358	.0360	.0129	.0105
3	.1786	-.036	-.0064	.0002	—
Σ	.4467	.341	.1526	.1035	.0572

$$I_e = .1607 - .341(.1526) = .1087 \text{ in.}^4$$

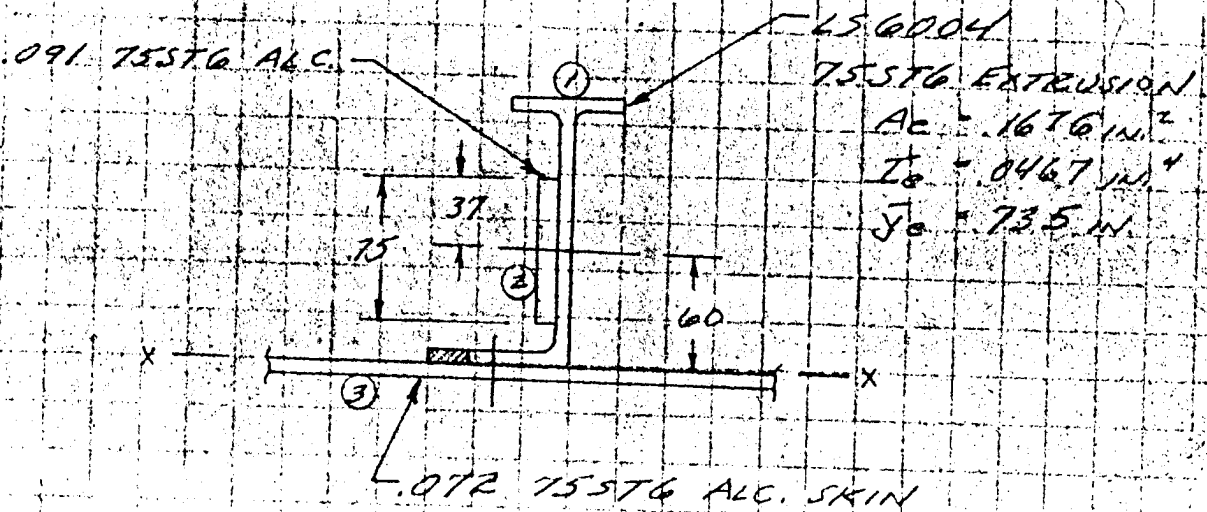
$$r = \sqrt{\frac{.1087}{.4467}} = .492 \text{ in.}$$

$$A_{\text{GROSS}} = .189 + .119 + 6(.072) = .739 \text{ in.}^2$$

$$I_{\text{GROSS}} = .117 \text{ in.}^4$$

$$\bar{y} = .198 \text{ in.}$$

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SECTION PROPERTIESLOWER SURFACE, STICK 20-22, 24-29STA. 70-124

$$F_{cl} = 66000 \text{ PSI} \quad (\text{REF. BASIC, PG. 32})$$

$$b_e = 10 \times 2.4 \times .072 = 1.73 \text{ in.}$$

11	AREA	$\bar{y}$	$A\bar{y}$	$A\bar{y}^2$	I_o
1	.1676	.735	.1230	.0904	.0467
2	.0682	.600	.0409	.0245	.0032
3	.1245	.036	-.0045	.0002	—
Σ	.3603	.443	.1594	.1151	.0499

$$I_e = .1650 - .443(.1594) = .0944 \text{ in.}^4$$

$$r = \sqrt{\frac{.0944}{.3603}} = .511 \text{ in.}$$

$$A_{\text{GROSS}} = .189 + .068 + 6(.072) = .689 \text{ in.}^2$$

$$I_{\text{GROSS}} = .115 \text{ in.}^4$$

$$\bar{y} = 2.09 \text{ in.}$$

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SECTION PROPERTIESLOWER SURFACE, SEGS 20-22, 24-29STA. 124-160

LS6004 BASIC AND .072 155TG ALL SKIN

 $b = 6.0 \text{ IN.}$ $F_{cc} = 66000 \text{ PSI. (SEE BASIC, PG. 32)}$ $b_e = 10 \times 2.4 \times .072 = 1.73 \text{ IN. (SM 23)}$

N	AREA	Y	AY	AY ²	I ₀
1	.1676	.735	.1230	.0904	.0467
2	.1245	-.036	-.0045	.0002	—
Σ	.2921	.406	.1185	.0906	.0467

$$I_e = .1373 - .406(.1185) = .0892 \text{ IN.}^4$$

$$\rho = \sqrt{\frac{.0892}{.2921}} = .553 \text{ IN.}$$

$$A_{\text{GROSS}} = .189 + 6(.172) = .621 \text{ IN.}^2$$

$$I_{\text{GROSS}} = .103 \text{ IN.}^4, \bar{y} = .176 \text{ IN.}$$

STA. 160-300

LS6004 BASIC AND .064 155TG ALL SKIN

 $b = 6.0 \text{ IN.}$ $F_{cc} = 66000 \text{ PSI. (SEE BASIC, PG. 32)}$ $b_e = 10 \times 2.5 \times .064 = 1.60 \text{ IN. (SM 23)}$

N	AREA	Y	AY	AY ²	I ₀
1	.1676	.735	.1230	.0904	.0467
2	.1024	-.032	-.0033	.0001	—
Σ	.2700	.444	.1197	.0905	.0467

$$I_e = .1372 - .444(.1197) = .0842 \text{ IN.}^4$$

$$\rho = \sqrt{\frac{.0842}{.2700}} = .558 \text{ IN.}$$

$$A_{\text{GROSS}} = .189 + 6(.064) = .573 \text{ IN.}^2$$

$$I_{\text{GROSS}} = .100 \text{ IN.}^4, \bar{y} = .197 \text{ IN.}$$

Prepared		DATE 11-22-55	LOCKHEED AIRCRAFT CORP. CALIFORNIA DIVISION	Page	29	TEMP.	36	STAT
Checked			TITLE WING	Model	L185			
Approved				Report No.	11056			

SECTION PROPERTIES

LOWER SURFACE STRIP, R2-R2, 24-29

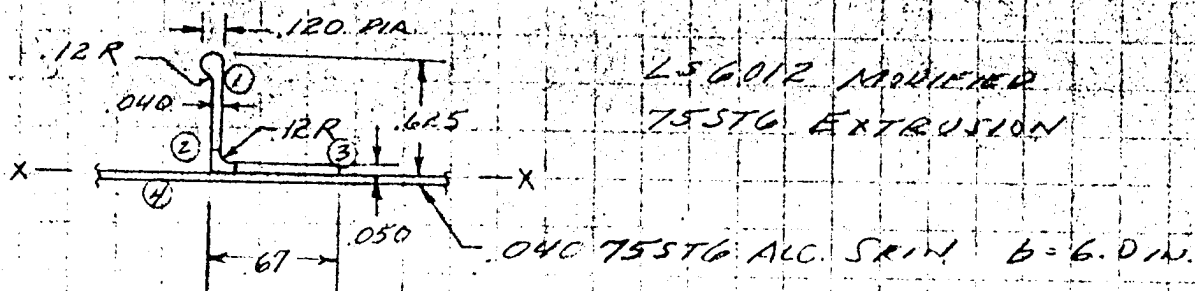
STA. 300-440

IDENTICAL TO UPPER SURFACE, EXCEPT THAT $b = 6.0$ INCHES. SEE PAGE 31 FOR PROPERTIES.

$$A_{GROSS} = .155 + 6(.051) = .461 \text{ IN}^2, \quad I_{GROSS} = .032 \text{ IN}^4$$

$$S_x = .099 \text{ IN}$$

LOWER SURFACE, STRIP (E), (F), (G)



n	AREA	b/t or P/t	F _{act}	P _{act}
1	.0219	12.9	46500	1300
2	.0104	1.8	81000	840
3	.0285	11.4	20900	595
Σ	.0608			2735

$$F_{CL} = \frac{2735}{.0608} = 44982 \text{ PSI}$$

$$b_e = 15.4 \times 2.5 \times .041 = 1.54 \text{ in.}$$

n	AREA	y	Ay	Ay ²	I _o
1	.0279	.416	.01159	.00531	.00020
2	.0104	.043	.00045	.00003	—
3	.0285	.025	.00071	.00002	.00001
Σ	.0668	.020	.00123	.00002	—
Σ	.1284	.090	.01158	.00538	.00021

$$I = .00559 - .090(.01158) = .00455 \text{ IN}^4$$

$$P = \sqrt{\frac{.00455}{.1284}} = .188 \text{ IN.}$$

$$A_{GROSS} = .155 + 6(.051) = .461 \text{ IN}^2$$

COMPRESSION IN UPPER SURFACE
~~TENSION~~

DATE 11-25-55 REP. 11056

REF. CODE: 11-45-53 MODEL: 11-45-53 DATE: 11-45-53 PAGE: 1038

TENSION 11 SHEAR 12 SURFACE 13

PLANE NO.	REF. CODE		DISTANCE FROM C.G. ABOUT C.G.		FIRST MOMENTS ABOUT C.G.		ACTUAL AREA		RECIPROCAL OF ACTUAL AREA		TWICE AREA BETWEEN CHORD & WEB		EFF. WEB MOM. COEF.	
	REF.		DIST.		F.M.		A		1/A		2A		C ₁₁ C ₂₂	
	PL.	REF.	HOR.	VERT.	HOR.	VERT.	HOR.	VERT.	HOR.	VERT.	HOR.	VERT.	HOR.	VERT.
1	520	220	12.25	-34.20	5.57	-12.15	2.84	3.7	37.6					
2	533	410	8.10	-30.33	5.72	-16.15	3.15	3.2	32.1					
3		420	8.70	-26.30	5.82	-14.02	3.16		22.5					
4		1260	8.40	-22.30	6.02	-11.47	3.21		26.3					
5		1660	8.30	-18.30	6.12	-9.75	3.26		27.7					
6		2060	8.50	-14.30	6.12	-7.62	3.26		26.2					
7		2460	8.70	-10.30	6.02	-5.49	3.21		26.2					
8		2860	8.30	-6.30	5.82	-3.36	3.16		25.6					
9		3260	8.10	-2.30	5.72	-1.23	3.05		25.4					
10		3660	8.00	+1.70	5.42	+.91	2.89		25.4					
11	533	4060	8.50	5.70	5.12	3.04	2.73		25.4					
12	800	4460	8.80	9.70	4.82	7.76	3.86		28.3					
13	533	4860	7.60	13.70	4.22	7.30	2.85		25.6					
14		5260	7.20	17.70	3.82	9.43	2.94		22.1					
15		5660	6.60	21.70	3.22	11.57	1.72		22.1					
16		6060	6.00	25.70	2.62	13.70	1.73		22.1					
17	533	6460	5.40	29.70	2.02	15.83	1.08		21.3					
18	530	6870	4.00	33.80	1.62	18.04	.89		20.5					
19	615	6770	-3.10	+32.80	-6.49	+18.54	-3.67	3.0	39.2					
20	739	6680	-3.00	28.70	-6.39	19.73	-4.71	3.0	39.9					
21	739	5560	-2.85	20.70	-6.33	15.30	-4.68	3.0	38.7					
22	739	4960	-2.85	14.70	-6.23	10.86	-4.60	2.5	32.9					
23	734	4460	-2.80	9.70	-6.18	7.12	-4.54	2.5	44.3					
24	739	3760	-2.55	4.70	-5.93	2.00	-4.38	3.0	38.0					
25		3160	-2.35	3.30	-5.73	2.44	-4.23		28.4					
26		2560	-2.05	9.30	-5.43	6.87	-4.01		12.7					
27		1960	-1.75	15.30	-5.13	11.31	-3.72		40.7					
28		1360	-1.50	21.30	-4.69	15.74	-3.42	3.0	45.7					
29	739	760	-.85	-2.30	-4.23	-26.17	-3.13	3.0	57.7					
30	616	600	-.20	-34.90	-3.58	-176.7	-1.02	3.0	578.8					

ONE CELL

TWO CELL

(THIS ANALYSIS ASSUMES TEMPORARY CUTS (~) AS SHOWN IN THE DIAGRAM.)

COMPUTATIONS

ROW	ITEM	REF. OR OPER.	DEC	VALUE	ROW	ITEM	REF. OR OPER.	DEC	VALUE	ROW
1	$\Sigma(Ax)$	$\Sigma(2)$	3	+639.479	1	$10^4 I_{xx} + I_{xx}^2 - I_{xy}^2$	(7)	3	+137.156	11
2	ΣA	$\Sigma(6)$	3	18.323	2	$10^4 I_{yy} + I_{yy}^2 - I_{xy}^2$	(8)	3	+2039.789	12
3	$\Sigma Ax^2 = \Sigma(Ax) \cdot \Sigma A$	$(1) \div (2)$	3	+3490	3	LOCATION OF $\bar{x}_R$	REF.			13
4	$\Sigma(Ay)$	$\Sigma(4)$	3	+61.945	4	REF. AXES	$\bar{x}_R$	PE.		14
5	$\Sigma Ay^2 = \Sigma(Ay) \cdot \Sigma A$	$(4) \div (2)$	3	+3.38	5					

$\Sigma \textcircled{7}$ AND $\Sigma \textcircled{8}$ SHOULD BE EQUAL (APPROX)

②, ③, ④, ⑤ & ⑥ ----- 5 PLACES
 ⑦ TO ⑨ INCL. ⑩ AND ⑪ ----- 3 PLACES
 ⑫ ----- 1 PLACE
 ⑬ & ⑭ ----- 2 PLACES

[illegible]

MODEL 4185 PAGE 32

1-2-3-4-5-6-7-8-9-10-11-12-13-14-15-16-17-18-19-20-21-22-23-24-25-26-27-28-29-30-31-32-33-34-35-36-37-38-39-40-41-42-43-44-45-46-47-48-49-50-51-52-53-54-55-56-57-58-59-60-61-62-63-64-65-66-67-68-69-70-71-72-73-74-75-76-77-78-79-80-81-82-83-84-85-86-87-88-89-90-91-92-93-94-95-96-97-98-99-100-101-102-103-104-105-106-107-108-109-110-111-112-113-114-115-116-117-118-119-120-121-122-123-124-125-126-127-128-129-130-131-132-133-134-135-136-137-138-139-140-141-142-143-144-145-146-147-148-149-150-151-152-153-154-155-156-157-158-159-160-161-162-163-164-165-166-167-168-169-170-171-172-173-174-175-176-177-178-179-180-181-182-183-184-185-186-187-188-189-190-191-192-193-194-195-196-197-198-199-200-201-202-203-204-205-206-207-208-209-210-211-212-213-214-215-216-217-218-219-220-221-222-223-224-225-226-227-228-229-230-231-232-233-234-235-236-237-238-239-240-241-242-243-244-245-246-247-248-249-250-251-252-253-254-255-256-257-258-259-260-261-262-263-264-265-266-267-268-269-270-271-272-273-274-275-276-277-278-279-280-281-282-283-284-285-286-287-288-289-290-291-292-293-294-295-296-297-298-299-300-301-302-303-304-305-306-307-308-309-310-311-312-313-314-315-316-317-318-319-320-321-322-323-324-325-326-327-328-329-330-331-332-333-334-335-336-337-338-339-340-341-342-343-344-345-346-347-348-349-350-351-352-353-354-355-356-357-358-359-360-361-362-363-364-365-366-367-368-369-370-371-372-373-374-375-376-377-378-379-380-381-382-383-384-385-386-387-388-389-390-391-392-393-394-395-396-397-398-399-400-401-402-403-404-405-406-407-408-409-410-411-412-413-414-415-416-417-418-419-420-421-422-423-424-425-426-427-428-429-430-431-432-433-434-435-436-437-438-439-440-441-442-443-444-445-446-447-448-449-450-451-452-453-454-455-456-457-458-459-460-461-462-463-464-465-466-467-468-469-470-471-472-473-474-475-476-477-478-479-480-481-482-483-484-485-486-487-488-489-490-491-492-493-494-495-496-497-498-499-500-501-502-503-504-505-506-507-508-509-510-511-512-513-514-515-516-517-518-519-520-521-522-523-524-525-526-527-528-529-530-531-532-533-534-535-536-537-538-539-540-541-542-543-544-545-546-547-548-549-550-551-552-553-554-555-556-557-558-559-560-561-562-563-564-565-566-567-568-569-570-571-572-573-574-575-576-577-578-579-580-581-582-583-584-585-586-587-588-589-590-591-592-593-594-595-596-597-598-599-600-601-602-603-604-605-606-607-608-609-610-611-612-613-614-615-616-617-618-619-620-621-622-623-624-625-626-627-628-629-630-631-632-633-634-635-636-637-638-639-640-641-642-643-644-645-646-647-648-649-650-651-652-653-654-655-656-657-658-659-660-661-662-663-664-665-666-667-668-669-670-671-672-673-674-675-676-677-678-679-680-681-682-683-684-685-686-687-688-689-690-691-692-693-694-695-696-697-698-699-700-701-702-703-704-705-706-707-708-709-710-711-712-713-714-715-716-717-718-719-720-721-722-723-724-725-726-727-728-729-730-731-732-733-734-735-736-737-738-739-740-741-742-743-744-745-746-747-748-749-750-751-752-753-754-755-756-757-758-759-760-761-762-763-764-765-766-767-768-769-770-771-772-773-774-775-776-777-778-779-780-781-782-783-784-785-786-787-788-789-790-791-792-793-794-795-796-797-798-799-800-801-802-803-804-805-806-807-808-809-810-811-812-813-814-815-816-817-818-819-820-821-822-823-824-825-826-827-828-829-830-831-832-833-834-835-836-837-838-839-840-841-842-843-844-845-846-847-848-849-850-851-852-853-854-855-856-857-858-859-860-861-862-863-864-865-866-867-868-869-870-871-872-873-874-875-876-877-878-879-880-881-882-883-884-885-886-887-888-889-890-891-892-893-894-895-896-897-898-899-900-901-902-903-904-905-906-907-908-909-910-911-912-913-914-915-916-917-918-919-920-921-922-923-924-925-926-927-928-929-930-931-932-933-934-935-936-937-938-939-940-941-942-943-944-945-946-947-948-949-950-951-952-953-954-955-956-957-958-959-960-961-962-963-964-965-966-967-968-969-970-971-972-973-974-975-976-977-978-979-980-981-982-983-984-985-986-987-988-989-990-991-992-993-994-995-996-997-998-999-1000-1001-1002-1003-1004-1005-1006-1007-1008-1009-1010-1011-1012-1013-1014-1015-1016-1017-1018-1019-1020-1021-1022-1023-1024-1025-1026-1027-1028-1029-1030-1031-1032-1033-1034-1035-1036-1037-1038-1039-1040-1

REF. CODE:

Form 1041

11

TENSION

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466
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DATE 11-28-51

REP. 44572

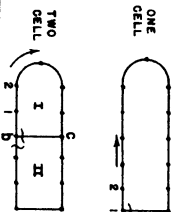
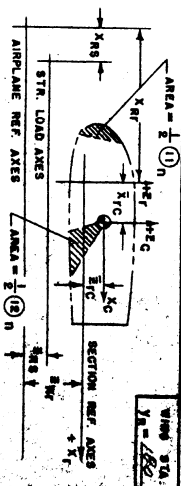
[illegible]

Diagram illustrating a three-cell structure with temporary cuts. The structure is divided into three vertical sections labeled I, II, and III. The top edge is labeled 'c' and the bottom edge is labeled 'e'. The left edge is labeled '2' and the right edge is labeled '1'. The middle section (II) is labeled 'b' and 'd'. The bottom section (III) is labeled 'o'. A curved arrow indicates a path from the top left corner, through the middle section, and down the right side.

(THIS ANALYSIS ASSUMES
TEMPORARY CUTS [~]
AS SHOWN IN THE DIAGRAM.)

THREE CELL



ROW	ITEM	REF. OR ORER.	QTY.	UNIT	VALUE	PRICE
11	$10^6 I_1 - I_2 - I_3 - I_4 - I_5$	373	4	200	3.17	11
12	$10^6 I_2 - I_3 - I_4 - I_5$	373	4	200	3.17	11
13	LOCATION OF I_1 REF. AXES	373	4	200	3.17	11
14	REF. AXES	373	4	200	3.17	11
15	LOCATION OF I_2 REF. AXES	373	4	200	3.17	11
16	LOAD AXES	373	4	200	3.17	11
17	C.G. RELATIVE TO LOAD AXES	373	4	200	3.17	11
18	SIN β	373	4	200	3.17	11
19	COS β	373	4	200	3.17	11
20	SIN β	373	4	200	3.17	11

[illegible]

TABULAR FORM

WING SECTION PROPERTIES AT STATION

1

TENSION

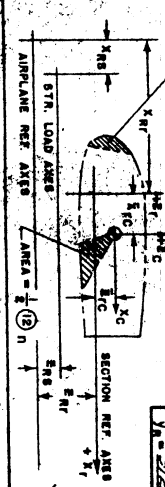
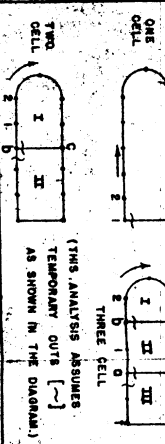
• 11

2011 2012

DATE 4-29-5

REP. 11052

PLANE OR WEB	MODIFIED PLANE AREA	DISTANCE FROM ENC. REF. AXIS			DISTANCE FROM O. G.			FIRST MOMENTS ABOUT O. G.			ACTUAL AREA	REMOVAL OF CHORD AREA	TWICE AREA BETWEEN MOD. COORD. & WEB	EFF. WEB CORRECT IN
		ENC. REF. AXIS	VERT. DIST.	HORIZ. DIST.	HORIZ. DIST.	VERT. DIST.	HORIZ. DIST.	VERT. DIST.						
									REF.	REF.				
1	10	10	10	10	10	10	10	10	10	10	10	10	10	10
2	10	10	10	10	10	10	10	10	10	10	10	10	10	10
3	10	10	10	10	10	10	10	10	10	10	10	10	10	10
4	10	10	10	10	10	10	10	10	10	10	10	10	10	10
5	10	10	10	10	10	10	10	10	10	10	10	10	10	10
6	10	10	10	10	10	10	10	10	10	10	10	10	10	10
7	10	10	10	10	10	10	10	10	10	10	10	10	10	10
8	10	10	10	10	10	10	10	10	10	10	10	10	10	10
9	10	10	10	10	10	10	10	10	10	10	10	10	10	10
10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
11	10	10	10	10	10	10	10	10	10	10	10	10	10	10
12	10	10	10	10	10	10	10	10	10	10	10	10	10	10
13	10	10	10	10	10	10	10	10	10	10	10	10	10	10
14	10	10	10	10	10	10	10	10	10	10	10	10	10	10
15	10	10	10	10	10	10	10	10	10	10	10	10	10	10
16	10	10	10	10	10	10	10	10	10	10	10	10	10	10
17	10	10	10	10	10	10	10	10	10	10	10	10	10	10
18	10	10	10	10	10	10	10	10	10	10	10	10	10	10
19	10	10	10	10	10	10	10	10	10	10	10	10	10	10
20	10	10	10	10	10	10	10	10	10	10	10	10	10	10
21	10	10	10	10	10	10	10	10	10	10	10	10	10	10
22	10	10	10	10	10	10	10	10	10	10	10	10	10	10
23	10	10	10	10	10	10	10	10	10	10	10	10	10	10
24	10	10	10	10	10	10	10	10	10	10	10	10	10	10
25	10	10	10	10	10	10	10	10	10	10	10	10	10	10
26	10	10	10	10	10	10	10	10	10	10	10	10	10	10
27	10	10	10	10	10	10	10	10	10	10	10	10	10	10
28	10	10	10	10	10	10	10	10	10	10	10	10	10	10
29	10	10	10	10	10	10	10	10	10	10	10	10	10	10
30	10	10	10	10	10	10	10	10	10	10	10	10	10	10
31	10	10	10	10	10	10	10	10	10	10	10	10	10	10
32	10	10	10	10	10	10	10	10	10	10	10	10	10	10



ROW	ITEM	REF ON OPEN	DEG	VALUE	ROW
1	FLA-1	E(00)	B	114.556	1
2	FLA-2	I(0)	B	6.513	2
3	FLA-3	I(1) + E	B	2.546	3
4	FLA-4	I(00)	B	12.191	4
5	FLA-5	E(00)	B	2.339	5
6	FLA-6	E(00)	B	2.873	6
7	FLA-7	E(00)	B	3.407	7
8	FLA-8	E(00)	B	123.747	8
9	FLA-9	E(00)	B	241.889	9
10	FLA-10	E(00)	B	74.587	10

NO.	ITEM	REF. OR ORG. NO.	VALUE
11	$10^5 X_1 + X_2 - 10^4$	7 0 5	+824.440
12	$10^5 X_1 + X_2 - 10^4$	0 0 3	+28746.538
13	LOCATION OF 1ST REF.	—	4220.50
14	REF. AXIS 2ND. NO.	—	18.8.30
15	LOCATION OF 2ND REF.	—	466.30
16	LOAD AREA 1ST. NO.	3 + 13 - 05	10.8.00
17	0.6. INCLIN. 15.0	2 - 20.54	—
18	TO LOAD AREA 250	2 + 14 - 18	+2.35
19	SIN. COS. θ	0.11 0.99	—
20	SIN. θ	0.11	0

[illegible]

DECIMAL PLACES FOR COLUMNS
 1 2 3 4 5 6 7 8 9 10 11 12
 1 2 3 4 5 6 7 8 9 10 11 12
 1 2 3 4 5 6 7 8 9 10 11 12
 1 2 3 4 5 6 7 8 9 10 11 12

REV.	1	2	3	4	5	6	7	8	9	10	11	12
DATE												

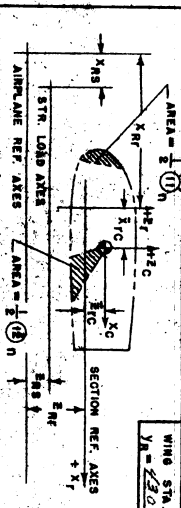
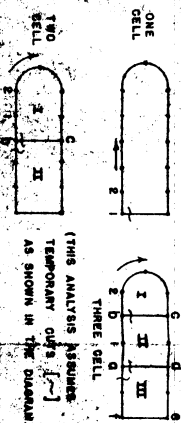
FORM 1
 1-1-60
 1-1-60
 1-1-60

TABULAR FORM 1 WING SECTION PROPERTIES AT STATION 432

COMPRESSION
 TENSION
 IN UPPER SURFACE

MODEL 4185
 DATE 4/24/55
 PAGE 43
 REP 11056

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000
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ITEM	REF. OR OPER. DEC.	VALUE	ITEM	REF. OR OPER. DEC.	VALUE
1. AREA	1	1.00	11. AREA	1	1.00
2. PERIMETER	2	2.00	12. AREA	2	2.00
3. MOMENT OF INERTIA	3	3.00	13. AREA	3	3.00
4. SECTION MODULUS	4	4.00	14. AREA	4	4.00
5. TORSION CONSTANT	5	5.00	15. AREA	5	5.00
6. ST. RESISTANCE	6	6.00	16. AREA	6	6.00
7. ST. RESISTANCE	7	7.00	17. AREA	7	7.00
8. ST. RESISTANCE	8	8.00	18. AREA	8	8.00
9. ST. RESISTANCE	9	9.00	19. AREA	9	9.00
10. ST. RESISTANCE	10	10.00	20. AREA	10	10.00

ITEM	REF. OR OPER. DEC.	VALUE	ITEM	REF. OR OPER. DEC.	VALUE
1. AREA	1	1.00	11. AREA	1	1.00
2. PERIMETER	2	2.00	12. AREA	2	2.00
3. MOMENT OF INERTIA	3	3.00	13. AREA	3	3.00
4. SECTION MODULUS	4	4.00	14. AREA	4	4.00
5. TORSION CONSTANT	5	5.00	15. AREA	5	5.00
6. ST. RESISTANCE	6	6.00	16. AREA	6	6.00
7. ST. RESISTANCE	7	7.00	17. AREA	7	7.00
8. ST. RESISTANCE	8	8.00	18. AREA	8	8.00
9. ST. RESISTANCE	9	9.00	19. AREA	9	9.00
10. ST. RESISTANCE	10	10.00	20. AREA	10	10.00

ITEM	REF. OR OPER. DEC.	VALUE	ITEM	REF. OR OPER. DEC.	VALUE
1. AREA	1	1.00	11. AREA	1	1.00
2. PERIMETER	2	2.00	12. AREA	2	2.00
3. MOMENT OF INERTIA	3	3.00	13. AREA	3	3.00
4. SECTION MODULUS	4	4.00	14. AREA	4	4.00
5. TORSION CONSTANT	5	5.00	15. AREA	5	5.00
6. ST. RESISTANCE	6	6.00	16. AREA	6	6.00
7. ST. RESISTANCE	7	7.00	17. AREA	7	7.00
8. ST. RESISTANCE	8	8.00	18. AREA	8	8.00
9. ST. RESISTANCE	9	9.00	19. AREA	9	9.00
10. ST. RESISTANCE	10	10.00	20. AREA	10	10.00

NORMAL PLACES FOR COLUMN

(8), (9), (10), (20) & (21) ----- 5 PLACES
 (5) TO (8) INCL. (22) AND (23) ----- 2 PLACES
 (10) ----- 6 PLACES
 (11) & (12) ----- 0 PLACES

[illegible]

FOIN
REVISED
1-27-42
1-28-42
2-24-42

TABULAR FORM 1

WING SECTION PROPERTIES AT STATION

430

COMPARISON TENSION

IN UPPER SURFACE

MODEL 4426
DATE 4-28-55

PAGE ~~44~~

FLANGE OR WEB	MODIFIED FLANGE AREA	DISTANCE FROM			DISTANCE FROM C.G.			FIRST MOMENTS ABOUT C.G.			ACTUAL AREA	RECOMMENDATION OF ACTUAL AREA	TWICE AREA BETWEEN CHORD & WEB	EFF. WEB MOM. COEFF.
		HORIZ. AXIS		VERT. AXIS	HORIZ. AXIS		VERT. AXIS	HORIZ. AXIS		VERT. AXIS				
		REP.	PER.	PER.	REP.	PER.	REP.	PER.	PER.	PER.				
1	PER.	PER.	PER.	PER.	PER.	PER.	PER.	PER.	PER.	PER.	PER.	PER.	PER.	
1	246	-4.50	+1.50		③ - 13	④ + 13	⑤ + 13	⑥ + 13	⑦ + 13	⑧ + 13	⑨ + 13	⑩ + 13	⑪ + 13	
2	563	8.00	1.70		-10.81	7.6	6.08	4.3						
3	359	+3.60	2.20		-7.21	1.06	-2.59	.38						
4	359	7.60	2.30		-3.21	1.16	-1.15	.42						
5	359	11.60	2.85		+1.78	1.11	+1.28	.40						
6	827	15.60	2.00		+1.78	8.6	3.96	.71						
7	359	19.60	1.65		8.79	.51	3.16	.18						
8	344	23.60	+1.50		12.79	.16	4.40	.06						
9	295	23.60	-1.20		12.79	-1.04	3.65	-.58						
10	192	18.40	-.80		8.29	-1.94	1.59	-.37						
11	329	18.60	-.75		4.99	+1.89	1.58	-.62						
12	24	21.60	-.65		-2.21	-1.79	-.48	-.39						
13	35	21.60	-.15		-8.21	-1.51	-1.77	-.34						
14	30	21.60	-.50		-16.81	+1.44	-2.79	-.37						
15	0	-3.00	-.25		-13.81	-1.34	0	0						
16														
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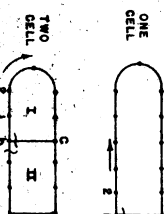
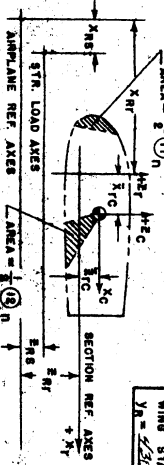


Diagram illustrating a three-cell temporary cut (cylindrical) configuration. The diagram shows three cells labeled I, II, and III, connected by a common base. The cells are arranged vertically, with Cell I at the top, Cell II in the middle, and Cell III at the bottom. The diagram is labeled "THREE CELL" and "TEMPORARY CUTS [~]".



NO.	ITEM	REF. OR ORGN.	QTY	VALUE	UNIT
1	EA(1)	E(03)	3	53.059	1
2	EA	10	3	4,910	1
3	EA	10	3	6,81	3
4	EA(1)	E(04)	3	5.558	4
5	EA(1)	E(04)	3	1.144	4
6	EA(1)	E(04)	3	9.88	5
7	EA(1)	E(04)	3	7.25	7
8	EA(1)	E(04)	3	1.94	7
9	EA(1)	E(04)	3	3.7211	9
10	EA(1)	E(04)	3	410.625	10

NO.	ITEM	REF. OR. OPER.	VAL.	REMARKS
1	$10^6 I_1 - I_2 - \frac{I_3^2}{2}$	1	+2861.35	
2	$10^6 I_2 - I_1 I_3 - \frac{I_3^2}{2}$	2	+145.26	
3	$10^6 I_3 - I_1 I_2 - \frac{I_3^2}{2}$	3	453.0	
4	LOCATION OF X	4	202.05	
5	REF. AXES	5	122.55	
6	LOAD AXES	6	102.00	
7	CG RELATIVE TO LOAD AXES	7	-16.09	
8	SIN θ	8	1.14	
9	COS θ	9	0.78	
10	SIN β	10	0	

[illegible]

Prepared		DATE 1-30-55	LOCKHEED AIRCRAFT CORP. CALIFORNIA DIVISION	Page	32	TEST RM. 45
Checked			TITLE <u>WING</u>	Model	L185	
Approved				Report No.	11056	

INTERNAL LOADSAXIAL LOADS AND BENDING STRESSES

AXIAL LOADS AND BENDING STRESSES ARE CALCULATED ON THE FOLLOWING TABLES BY MEANS OF CONVENTIONAL UNIT BEAM METHODS. GROUND LOAD AND THE SWEEP ANGLE (4°) ARE NEGLECTED.

STA. 36

AXIAL LOADS AT THIS STATION ARE DERIVED FROM THE WING-FUSELAGE JOINT LOAD DISTRIBUTION AS DISCUSSED IN LR 11057, Pg. 22 FOR THE CRITICAL ± 15 FPS GUST CONDITIONS. COUPLE LOADS ON THE FRAMES ARE DISTRIBUTED TO THREE FLANGES ON THE UPPER SURFACE AND TO TWO FLANGES ON THE LOWER SURFACE.

 ± 15 FPS GUST @ V_0

$$P_{\text{COUPLE}} = 71,000 \text{ LBS. (LR 11057, Pg. 22)}$$

$$P_{\text{UPPER}} = \frac{71,000}{3} = -23,700 \text{ LBS. (COMP.)}$$

$$P_{\text{LOWER}} = \frac{71,000}{2} = 35,500 \text{ LBS. (TENS.)}$$

 -15 FPS GUST @ V_0

$$P_{\text{COUPLE}} = \frac{2.6}{4.5} \times 71,000 = 41,000 \text{ LBS.}$$

$$P_{\text{UPPER}} = \frac{41,000}{3} = 13,700 \text{ LBS.}$$

$$P_{\text{LOWER}} = -\frac{41,000}{2} = -20,500 \text{ LBS.}$$

TABULAR FORM 2

REF. CODE: (col) tab

BENDING STRESSES AND AXIAL LOADS AT STATION 36

MODEL 4185 PC 1-55
DATE 12-30-55 REP 11056

STA 36

FL or Web	BENDING STRESSES			AXIAL LOADS		
	Case and Condition	Case and Condition	Case and Condition	Case and Condition	Case and Condition	Case and Condition
1	15fps	30fps	15fps	15fps	30fps	15fps
2	GUST	GUST	GUST	GUST	GUST	GUST
3						
4						
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STA. 70

MODEL 4155 P.C. 47
DATE 4-30-55 REP. 11056

[illegible]

REF CODE: 6004

MODEL 11050 P.C. 48
DATE 11-27-55 REP. 11050

STA. 180

BENDING STRESSES		AXIAL LOADS	
Case and Condition		Case and Condition	
①	②	③	④
⑤, when ⑥ = ⑦, or ⑧, when ⑨ ≠ ⑩	⑪, when ⑫ = ⑬, or ⑭, when ⑮ ≠ ⑯	⑰, when ⑱ = ⑲, or ⑳, when ㉑ ≠ ㉒	㉓, when ㉔ = ㉕, or ㉖, when ㉗ ≠ ㉘
1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16
17	18	19	20
21	22	23	24
25	26	27	28
29	30	31	32
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37	38	39	40
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53	54	55	56
57	58	59	60
61	62	63	64
65	66	67	68
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97	98	99	100

TABULAR FORM 2

REF CODE: col tab

BENDING STRESSES AND AXIAL LOADS AT STATION 312

MODEL CLIP 5 PG. 49
DATE 11-15-55 REP 11056

STA. 312

FL										BENDING STRESSES										AXIAL LOADS									
Case and Condition										Case and Condition										Case and Condition									
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TABULAR FORM 2

BENDING STRESSES AND AXIAL LOADS AT STATION 430

MODEL 4145 50
DATE 11-20-53 REV 11056

REF CODE: (C) Tab

STA 430

FL or Web	BENDING STRESSES Case and Condition	AXIAL LOADS Case and Condition	
		(1) (2) (3) (4) (5) (6) (7) (8) (9)	(1) (2) (3) (4) (5) (6) (7) (8) (9)
1	405. 75751 TIP SKID GUST	430405. 75751 TIP SKID GUST	
2	(2) (3) (4) (5) (6) (7) (8) (9)	(2) (1) (2) (3) (4) (5) (6) (7) (8) (9)	
3	-1886 -4714 -165	-279 -698 -41	
4	-3536 -8840 +1332	-1764 -4411 +750	
5	-4790 -11975 2473	-1157 -2398 888	
6	-5409 -13523 3073	-1309 -3273 1103	
7	-5530 -13835 3242	-1338 -3346 1164	
8	-4989 -12473 2839	-3751 -9380 2248	
9	-4185 -10288 2149	-995 -2490 771	
10	-3242 -8105 1459	-923 -2310 502	
11	+4054 +10135 -4845	+1800 +4500 -1380	
12	4046 10115 -4910	1618 4046 -943	
13	4132 10330 -5041	2314 5785 -1658	
14	4295 10738 -5201	1868 4671 -1145	
15	4671 10178 -5198	1771 4427 -1123	
16	5760 9400 -4971	1545 3863 -1273	
17	8810 9525 -5063	610 1524 0	

Plates for Cols.
All cols - 0 plates

Rev.
Dates:

Prepare		DATE 12-8-55	LOCKHEED AIRCRAFT CORP. CALIFORNIA DIVISION	Page	STAT 45 51
Checked			TITLE WING	Model	L185
Approved				Report No.	11056

INTERNAL LOADSWEB SHEAR FLOWS

CALCULATIONS AT STATIONS 36, 180, 312 AND 430 ARE PRESENTED ON THE FOLLOWING TABLES WHICH SHOW THE METHOD USED TO DEVELOPE THE INTERNAL WEB SHEAR FLOWS. RATHER THAN USING $\Delta P/d$ SHEAR FLOWS AT MID-STATIONS AS PER THE USUAL UNIT BEAM ANALYSIS, THE SHEAR FLOWS ARE CALCULATED AT EACH ANALYSIS STATION IN THE FOLLOWING MANNER:

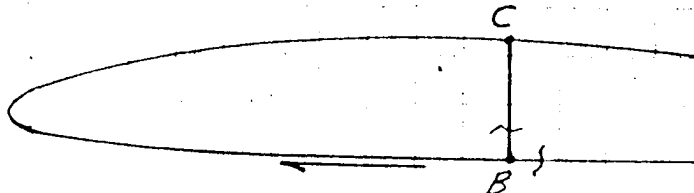
1. "OPEN SECTION" SHEAR FLOWS

a. USING NET BEAM SHEAR (CORRECTED FOR BEAM TAPER) CALCULATE $\Delta P/d$ OPEN SECTION SHEAR FLOWS BY MULTIPLYING AXIAL LOADS AT THE STATION BY THE RATIO $K_z = \frac{\Delta M_x}{M_x}$ WHERE:

$$\Delta M_x = 1.00 \times S_z' \text{ (IN LBS.)}$$

b. THEN,

$$q_{on} = \sum_B^{B-1} K_z P_{AXIAL}$$



2. FINAL SHEAR FLOWS

THE TWO CELL BOX IS THEN CLOSED AND FINAL SHEAR FLOWS CALCULATED IN THE CONVENTIONAL MANNER USING TABULAR FORM C-3.

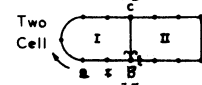
TABULAR FORM C-3

TWO } CELL BEAM SHEAR FLOW COMPUTATIONS FOR STA. 36

MODEL L185 PG. 46 52

DATE 12-9-55 REP. 11056

11000 STA. 36



(This analysis assumes
temporary cuts [~]
as shown in diagram)

Dec. Places for Cols.

- All cols. - - 0 places

Form
Revised
11-11-41
2-24-42
3-12-43

REF. CODE:

col tab. sta. row tab

Ⓢ web or tab.

FOR CONDITIONS OF ~~TENSION~~ COMPRESSION IN UPPER SURFACE

TWO CELL ONLY

TWO CELL ONLY

Row	Item, Reference, or Operation	Dec.	Value	Row
1	Σc_n^{-1}	$\Sigma c_n^{-1} \text{①}$	0	477
2	Σc_n^{-1}	$\Sigma c_n^{-1} \text{①}$	0	577
3	c_{bc} inb. sta.	$\text{⑤c ⑥b - ⑤b ⑥c inb.T-I}$	0	—
4	c_{bc} out. sta.	$\text{⑤c ⑥b - ⑤b ⑥c out.T-I}$	0	—
5	c_{bc} mid. sta.	$.5 \text{ [3] + [4]}$	0	-107
6	Twice cell gaps	[1] - [5]	0	1236
7	A_x	[2] + [5]	0	472

Row	Item, Reference, or Operation	Dec.	Value	Row
8	$\Sigma E^{-1} \cdot 5n/t_n$			8
9	$\Sigma E^{-1} \cdot 5n/t_n$			9
10	$\Sigma E^{-1} \cdot 5n/t_n \div A_2$			10
11				11
12				12
13				13
14				14

[illegible]

TABULAR FORM C-3

CELL BEAM SHEAR FLOW COMPUTATIONS FOR ~~WEB~~ STA. 180

MODEL 4135 PG. 4753DATE 12-8-53 REP. 11056STA. 180

FOR CONDITIONS OF COMPRESSION IN UPPER SURFACE

REF. CODE: row tab.
 (a) web or tab.

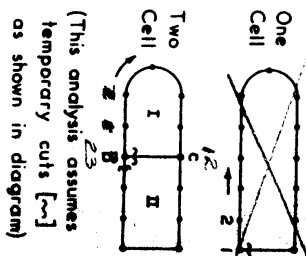
Form Revised 11-11-41
 2-24-42
 3-12-43

TWO CELL ONLY

Row	Item, Reference, or Operation	Dec.	Value	Row
1	$\Sigma b^{-1} c_n$	0	650	1
2	$\Sigma b^{-1} c_n$	0	350	2
3	inb. sta. $\left[\begin{smallmatrix} (5) & (6) & (7) & (8) & (9) & (10) & (11) & (12) \end{smallmatrix} \right]$	0	—	3
4	out. sta. $\left[\begin{smallmatrix} (5) & (6) & (7) & (8) & (9) & (10) & (11) & (12) \end{smallmatrix} \right]$	0	—	4
5	mid. sta. $\left[\begin{smallmatrix} (5) & (6) & (7) & (8) & (9) & (10) & (11) & (12) \end{smallmatrix} \right]$	0	—	5
6	Twice A_x	0	236	6
7	cell drcs A_x	0	264	7

TWO CELL ONLY

Row	Item, Reference, or Operation	Dec.	Value	Row
8	$\Sigma b^{-1} 3n/h_n$	0	1832	8
9	$\Sigma b^{-1} 3n/h_n$	0	693	9
10	$\Sigma b^{-1} 3n/h_n \div A_x$	5	2.5574	10
11	$\left[\begin{smallmatrix} (8) & (9) & (10) & (11) & (12) \end{smallmatrix} \right] \div (10)$	5	0.6774	11
12	$\left[\begin{smallmatrix} (8) & (9) & (10) & (11) & (12) \end{smallmatrix} \right] \div (10)$	5	2.5574	12
13	$\left[\begin{smallmatrix} (8) & (9) & (10) & (11) & (12) \end{smallmatrix} \right] \div (10)$	5	3.84370	13
14	$\left[\begin{smallmatrix} (8) & (9) & (10) & (11) & (12) \end{smallmatrix} \right] \div (10)$	0	-3.874	14



Dec. Places for Cols.
 All cols. - - 0 places

ONE OR TWO CELL										ONE CELL										TWO CELL ONLY									

MODEL 4145 PG. 54
DATE 12-9-55 REP. 11056

STA. 312

FOR CONDITIONS OF COMPRESSION IN UPPER SURFACE

TWO CELL ONLY

Form Revised	Web		
11-11-41	"n"	$5 \left[\begin{matrix} (12) \text{ ind.} \\ + (12) \text{ out.} \end{matrix} \right] + \begin{matrix} (16) \text{ ind.} \\ (47) \text{ out.} \end{matrix}$	
2-24-42	"a"	21	100
3-12-43	"f"	19	100

REF. CODE: row job. row job.

FOR CONDITIONS OF COMPRESSION IN UPPER SURFACE

STATION: 110000-000

NO. OF SPANS: 00

Form revised -11-41 -24-42 -12-43

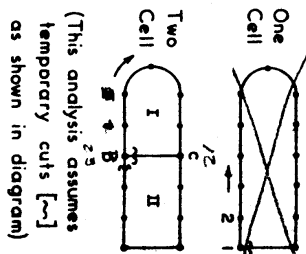
F1	①	②
Web	Stn. Average	Stn. Average
or	Web Mom	Eff. In
Web	Constant	Eff. In
n	5 [12] inb + 5 [17] inb + 12 out + 18 out	
2	21	100
3	19	100
4	18	85
5	15	78
6	14	
7	14	
8	14	
9	14	
10	14	
11	14	
12	16	
13	15	78
14	19	85
15	23	122
16	22	147
17	22	147
18	22	147
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96	22	147
97	22	147
98	22	147
99	22	147
100	22	147

Dec. Places for Cols. All cols. - - 0 places

One Cell

Two Cell

(This analysis assumes temporary cuts [~] as shown in diagram)



Dec. Places for Cols.
All cols. -- 0 places

TABULAR FORM C-3

ONE CELL BEAM SHEAR FLOW COMPUTATIONS FOR ~~IND~~ STA. 430

MODEL 4455 PG. 58

DATE 12-12-58 REP 11056

IND STA. 430

REF. CODE: (1) (2) (3) (4) (5) (6) (7) (8) (9) (10) (11) (12) (13) (14) (15) (16) (17) (18) (19) (20) (21) (22) (23) (24) (25) (26) (27) (28) (29) (30) (31) (32) (33) (34) (35) (36) (37) (38) (39) (40) (41) (42) (43) (44) (45) (46) (47) (48) (49) (50) (51) (52) (53) (54) (55) (56) (57) (58) (59) (60) (61) (62) (63) (64) (65) (66) (67) (68) (69) (70) (71) (72) (73) (74) (75) (76) (77) (78) (79) (80) (81) (82) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92) (93) (94) (95) (96) (97) (98) (99) (100) (101) (102) (103) (104) (105) (106) (107) (108) (109) (110) (111) (112) (113) (114) (115) (116) (117) (118) (119) (120) (121) (122) (123) (124) (125) (126) (127) (128) (129) (130) (131) (132) (133) (134) (135) (136) (137) (138) (139) (140) (141) (142) (143) (144) (145) (146) (147) (148) (149) (150) (151) (152) (153) (154) (155) (156) (157) (158) (159) (160) (161) (162) (163) (164) (165) (166) (167) (168) (169) (170) (171) (172) (173) (174) (175) (176) (177) (178) (179) (180) (181) (182) (183) 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Prepared		DATE 12-8-53	LOCKHEED AIRCRAFT CORP. CALIFORNIA DIVISION						Page	50	STAT. RM. 56
Checked			TITLE WING						Model L785		
Approved			COMPRESSION IN UPPER SURFACE						Report No. 11156		
TAB FORM 3 BOX SHEAR FLOWS AT STATION 36											
	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪
WEB	WEB	$S_n - t_n$	+ 15 FPS GUST			+ 30 FPS GUST					
*N	MON. CONST.		PANEL	q_{on} [K/2]	* q_n	PANEL	q_{on} [K/2]	* q_n	PANEL	q_{on} [K/2]	* q_n
1	38	64	-23700	+866	+224	-22200	+702	+390			
2	32	56	↑	787	145	↑	638	326			
3	30	↑		708	+66		574	262			
4	26	↑		629	-13		510	198			
5	28	↑		550	-92		446	134			
6	26	↑		472	-170		382	70			
7	26	↑		393	-249		318	+6			
8	26	↑		314	-328		254	-58			
9	25	↑		235	-407		190	-122			
10	25	↑		156	-486		126	-186			
11	25	↑		+77	-565		+62	-250			
C 12	28	↓		-1	-4		-2	+212			
13	26	↓		-80	-83		-66	148			
14	29	↓		-159	-162		-130	84			
15	27	↓		-238	-241		-194	+20			
16	21	56		-317	-320		-258	-44			
17	21	43	↓	-345	-398	↓	-323	-109			
18	266	159	-23700	-474	-477	-23200	-387	-173			
19	37	85	+35500	-356	-359	+33200	-291	-77			
20	46	83	↑	-238	-241	↑	-175	+19			
21	37	85	↑	-120	-123	↑	-99	115			
22	33	69		-2	-5		-3	+211			
B 23	44	91		+118	-524		+96	-216			
24	38	83		236	-406		192	-120			
25	30	↑		354	-288		287	-25			
26	38	↑		472	-170		393	+71			
27	41	↓		590	-52		479	167			
28	41	83		708	+66		575	263			
29	54	107	↓	827	185	↓	670	358			
30	578	1080	+35500	945	+303	+33200	766	454			
BC		275			+639			+526			

Prepared		DATE 12-8-55	LOCKHEED AIRCRAFT CORP. CALIFORNIA DIVISION	Page	STAT ^{RM.} 127
Checked			TITLE WING	Model	L195
Approved				Report No.	11056

TAB FORM 3

BOX SHEAR FLOWS AT STATION 180

COMPRESSION IN UPPER SURFACE

	(1)	(2)	(2)	(1)	(2)	(2)	(1)	(2)	(2)	(1)	(2)
WEB	W/B MOM.	S_n	+15 FPS GUST			+30 FPS GUST					
"	CONST.	t_n	PARIAL	Q_{on}	* Q_n	PARIAL	Q_{on}	* Q_n	PARIAL	Q_{on}	* Q_n
				$\left\{ \begin{matrix} B-1 \\ K_2 \end{matrix} \right\} \left(\frac{Q}{B} \right)$			$\left\{ \begin{matrix} B-1 \\ K_2 \end{matrix} \right\} \left(\frac{Q}{B} \right)$			$\left\{ \begin{matrix} B-1 \\ K_2 \end{matrix} \right\} \left(\frac{Q}{B} \right)$	
a	42	100	-2656	+1107	+531	-2656	+991	+634			
b	33	100	-3692	1082	506	-3692	969	612			
c	35	112	-4931	1050	474	-4931	940	583			
1	34	81	-22025	904	328	-22025	810	453			
5	25	63	-14626	807	231	-14626	723	366			
6	24		-15493	705	129	-15493	631	274			
7	23		-16214	598	+22	-16214	535	178			
8	23		-16496	489	-87	-16496	438	+81			
9	23		-16631	379	-197	-16631	339	-18			
10	23		-16401	270	-306	-16401	242	-115			
11	21		-15804	+166	-410	-15804	+149	-208			
C	12	23	-40580	-102	+12	-40580	-92	+166			
	13	25	-13880	-194	-80	-13880	-174	84			
	14	25	-12552	-277	-163	-12552	-248	+10			
	15	31	-11224	-351	-237	-11224	-315	-57			
	18	165	-16811	-462	-348	-16811	-414	-156			
	19	29	+24628	-300	-186	+24628	-268	-10			
	21	26	22352	-152	-38	22352	-136	-122			
	22	21	23400	+3	+117	23400	+3	+261			
B	23	29	28590	+189	-387	28590	+169	-188			
	24	24	24148	349	-227	24148	312	-45			
	25	25	24185	508	-68	24185	455	+98			
	26	26	23548	664	+88	23548	595	238			
	27	26	22237	811	235	22237	726	367			
	28	15	16682	921	345	16682	824	467			
	30	28	15095	1021	445	15095	915	558			
e	41	150	9223	1082	506	9223	969	612			
f	129	188	6354	1124	+548	6354	1007	+650			
BC		250			+690			+615			

*

Box SLEAK FIVE AT STATION 312

COMPRESSION IN UPPER SURFACE											
(1, 3)			(2)	(1)	(2)	(2)	(1)	(2)	(2)	(1)	(2)
1466	WEB	$\frac{S_m}{t_n}$	+ 30 FPS GUST			+ ROLL					
"91"	MEM.	$\frac{t_n}{t_n}$	AXIAL	$\frac{F_{on}}{K_2 \text{ (2)}}$	F_n	AXIAL	$\frac{F_{on}}{K_2 \text{ (2)}}$	F_n	AXIAL	$\frac{F_{on}}{K_2 \text{ (2)}}$	F_n
	CONST										
a	21	100	-1461	+710	+484	-1272	+657	+209			
d	19	100	-2230	681	455	-2465	630	182			
1	18	86	-12825	552	306	-11170	510	+62			
7	15	78	-7262	478	252	-6325	443	-5			
8	14	↑	-7765	400	174	-6763	370	-78			
9	14		-7997	317	93	-6965	295	-153			
10	14		-8230	236	+10	-7168	218	-230			
11	15		-7920	+156	-70	-6898	+144	-304			
12	16	↓	-22903	-75	+91	-19948	-70	-132			
13	15	78	-6218	-139	+27	-5416	-128	-190			
14	19	89	-5367	-173	-27	-4674	-179	-241			
18	23	102	-4734	-241	-75	-4103	-223	-285			
19	22	141	+1154	-117	+47	+10525	-110	-172			
21	15	78	11516	-2	+164	10004	-2	-64			
23	20	127	11167	+156	-68	13017	+147	-301			
24	17	118	12150	291	+65	11410	270	-178			
25	12	118	11007	411	175	11139	347	-59			
26	10	100	11883	536	310	7714	432	+49			
27	5	85	4111	630	404	2091	383	135			
28	12	120	5787	601	443	3425	617	171			
F	11	150	19011	+705	479	+4714	+671	+233			
29					+312			+386			

* $f_{100} = f_{00} + (9)_{0-3} = f_{00} + (15)_{0-3}$

COMPRESSION IN SPICE SURFACE

$$* \quad f_{p \rightarrow c-1} = f_{0n} + (16)_{03}, \quad f_{c \rightarrow B-1} = f_{0n} + (15)_{03}$$

WING
BENDING & TORSIONAL
STIFFNESS

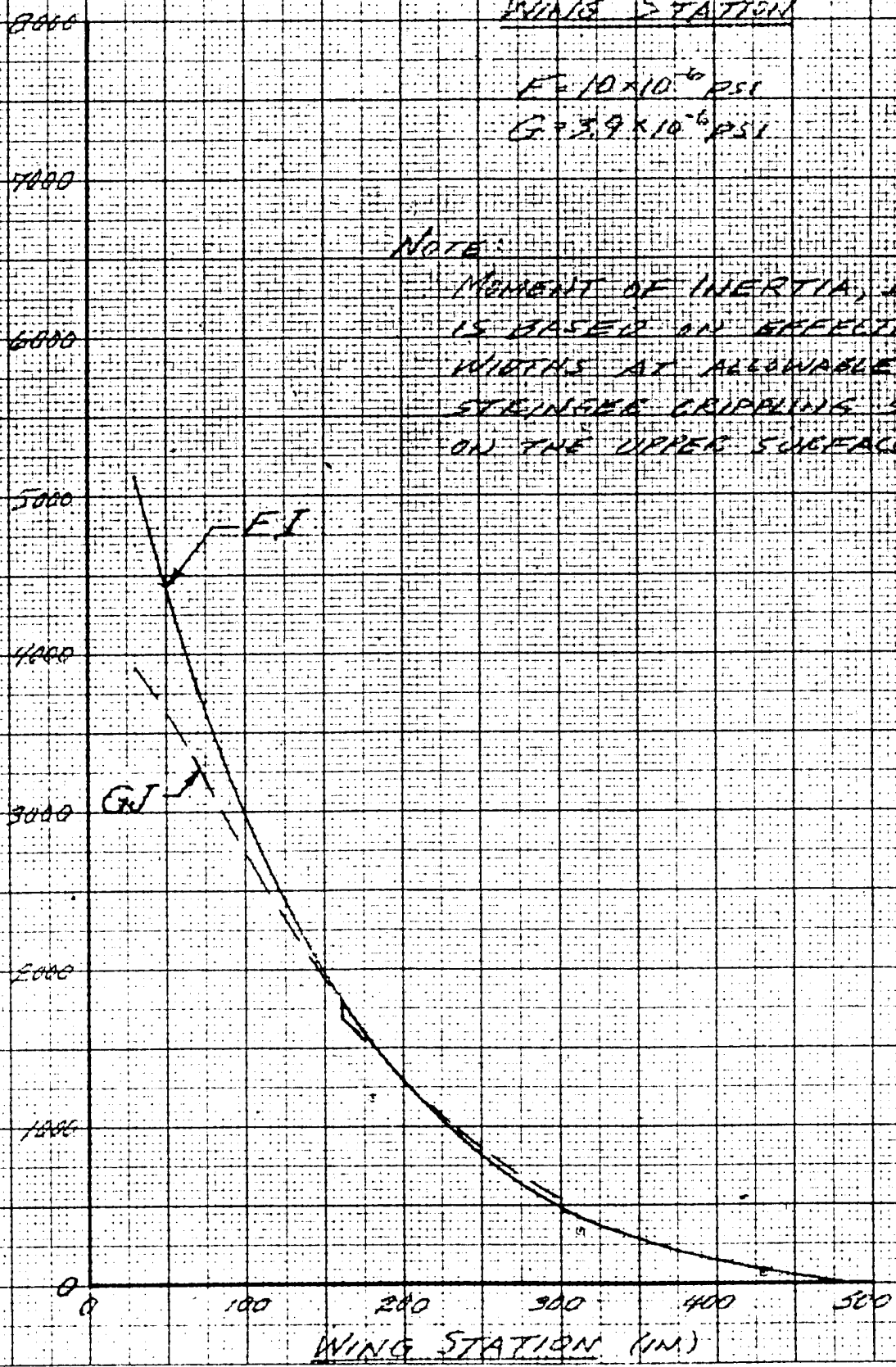
VS
WING STATION

$E = 10 \times 10^6 \text{ PSI}$
 $G = 3.9 \times 10^6 \text{ PSI}$

NOTE:

MOMENT OF INERTIA, I_x ,
 IS BASED ON EFFECTIVE
 WIDTHS AT ALLOWABLE
 STRINGER CRIPPLING STRESS
 ON THE UPPER SURFACE.

EI AND GJ (LB-IN.²) $\times 10^{-6}$



WING STATION (IN)

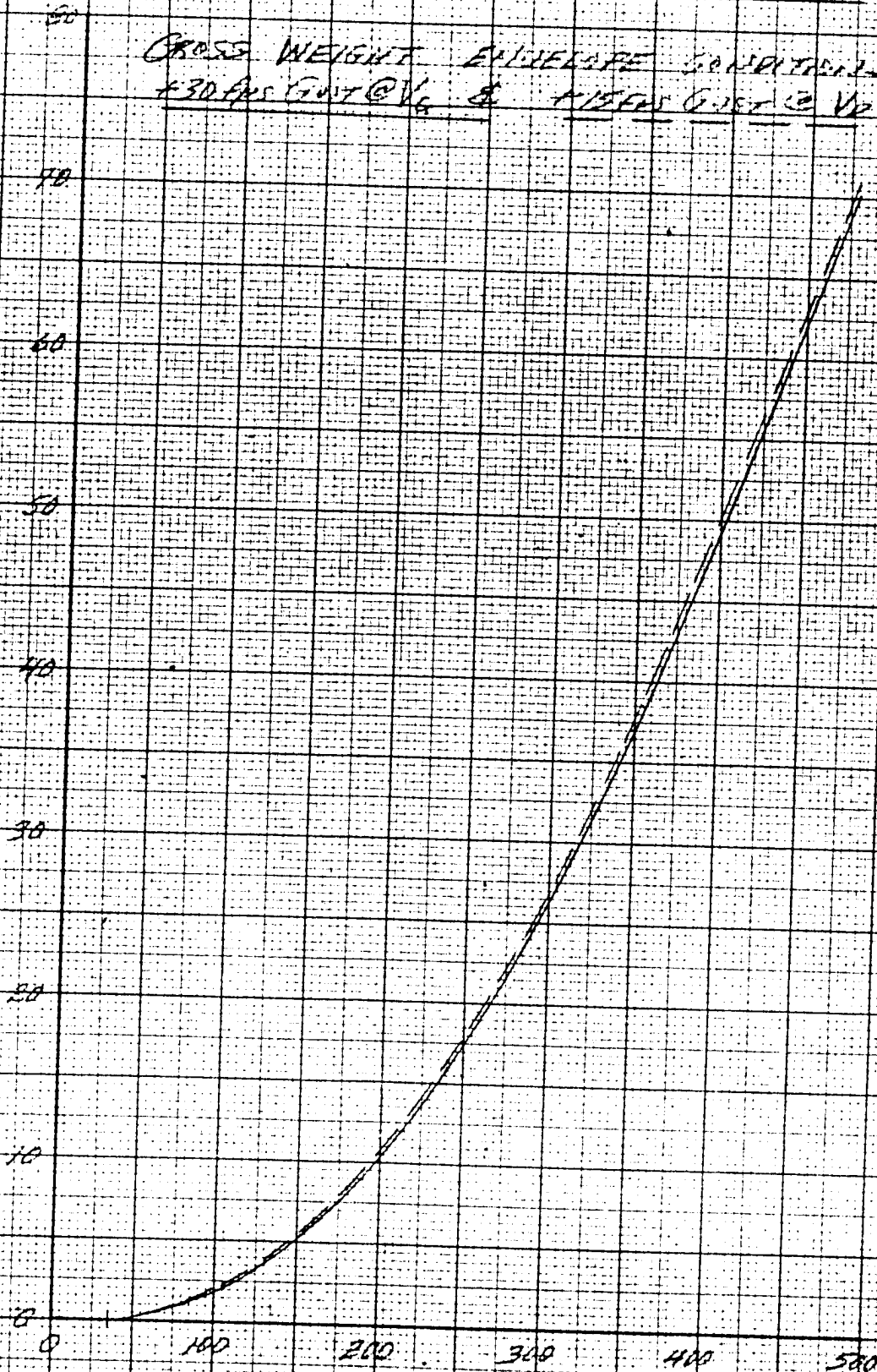
Prepare		DATE		LOCKHEED AIRCRAFT CORP.		Page		TEMP		STAT	
		12-13-55		CALIFORNIA DIVISION		53		53		141	
Checked		TITLE		WING		Model		L1E5		Report No. 11056	
Approved											
		+15 FPS GUST CONDITION (GROSS WT ENVELOPE)				+15 FPS GUST CONDITION (GROSS WT ENVELOPE)					
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Y	$\frac{\Delta Y}{Z}$	E.I. $\times 10^{-6}$ (Pg. 60)	$M_x \times 10^{-6}$ LIMIT (Pg. 17)	M_x/EI $= \frac{(4)}{(3)}$	θ $\sum_{0}^{(2)} \frac{(5)}{(6)}$	δ_z $\sum_{0}^{(2)} \frac{(6)}{(7)}$	$M_x \times 10^{-6}$ LIMIT (Pg. 17)	M_x/EI $= \frac{(4)}{(3)}$	θ $\sum_{0}^{(2)} \frac{(5)}{(6)}$	δ_z $\sum_{0}^{(2)} \frac{(6)}{(7)}$	
0	19	10240	2.750	.000269	0	—	2.970	.000290	0	—	
36-		10240	2.750	.000269	.010	—	2.970	.000290	.010	—	
36+	11	5120	2.750	.000537	.010	0	2.970	.000580	.010	0	
70	18	3770	2.330	.000623	.029	66	2.450	.000650	.031	.70	
106	37	2450	1.733	.000678	.053	2.14	2.000	.000702	.056	2.26	
180	30	1530	1.160	.000758	.106	8.02	1.160	.000758	.110	8.40	
240	36	710	.700	.000769	.152	15.8	.667	.000733	.154	16.3	
312	24	420	.310	.000738	.206	28.6	.300	.000714	.207	29.3	
360	35	260	.140	.000538	.237	39.3	.140	.000538	.237	40.0	
430	25	92	.020	.000217	.263	56.8	.020	.000217	.263	57.5	
480		—	0	0	.268	70.1	0	0	.268	70.8	

CHECKED BY: _____

CALIFORNIA DIVISION

PAGE 62
MODEL L185
REPORT NO. 11056LIMIT
WING DEFLECTIONGROSS WEIGHT ENVELOPE CONDITIONS
+30 FPS GUST @ V_G & +15 FPS GUST @ V_D

VERTICAL DEFLECTION, IN. (MAX.)

WING STATION (in.)

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NORMAL LOADSFUEL PRESSURE

FUEL TANK PRESSURE IS CONSERVATIVELY BASED ON ULTIMATE WING DEFLECTION AND ULTIMATE LOAD FACTOR SO THAT IT MAY BE COMBINED WITH CRUSHING PRESSURE BASED ON ULTIMATE LOAD. CRITICAL PRESSURES OCCUR IN THE MAIN TANK WHICH EXTENDS FROM W.S. 36 TO W.S. 440. IN ADDITION TO THE INERTIA HEAD, FUEL FEED IS ASSISTED BY BLEED PRESSURE REGULATED AT 1.5 PSI LIMIT.

CRITICAL CONDITIONS ARE THE ± 30 AND ± 15 FPS GUSTS AND THE ENVELOPE DEFLECTION CURVES ARE CONSERVATIVELY USED IN COMBINATION WITH THE LOAD FACTOR AT $W=17192$ LBS. (MAIN TANK FULL). FUEL DENSITY IS .0282 LBS./CU. IN.

 ± 30 FPS GUST CONDITION

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
WING STA.	δ_z (ULT.) 15 (P. 62)	h_{FUEL} δ_{z440} (2)	P_{HEAD} .0282 (3)	η_z (ULT.) LR 11055 P. 2.04	P_n (4) (5)	$P_{APPLIED}$ (ULT.)	P_{TOTAL} (6) + (7)
36	0	90.4	2.55	4.52	11.5	2.2	13.7
70	1.0	87.4	2.52	↑	11.4	↑	13.6
180	12.0	75.4	2.21	↑	10.0	↑	12.2
312	42.9	47.5	1.34	↓	6.0	↓	8.2
440	90.4	0.0	0	4.52	0.0	2.2	2.2

 ± 15 FPS GUST CONDITION

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
WING STA.	δ_z (ULT.) 15 (P. 62)	h_{FUEL} δ_{z440} (2)	P_{HEAD} .0282 (3)	η_z (ULT.) LR 11055 P. 2.04	P_n (4) (5)	$P_{APPLIED}$ (ULT.)	P_{TOTAL} (6) + (7)
36	0	89.5	2.52	4.92	12.4	2.2	14.6
70	1.0	88.5	2.50	↑	12.3	↑	14.5
180	12.6	76.9	2.16	↑	10.6	↑	12.8
312	43.9	45.6	1.28	↓	6.3	↓	8.5
440	91.5	0.0	0	4.92	0.0	2.2	2.2

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NORMAL LOADS (CONT'D)
CRUSHING PRESSURE

SURFACE CRUSHING PRESSURES ARE BASED ON THE ULTIMATE STRESS ON THE UPPER SURFACE AS FOLLOWS:

$$P_{\text{CRUSH}} = \frac{F \cdot A}{Z \cdot E \cdot a}$$

WHERE,

- F ~ ULTIMATE STRESS IN FLANGE
 A ~ FLANGE EFFECTIVE AREA
 Z ~ VERTICAL DISTANCE FROM FLANGE TO C.G. OF SECTION
 E ~ MODULUS OF ELASTICITY = 10^7 PSI
 a ~ FLANGE SPACING = 4.0 IN. (UPPER SURFACE).

	①	②	③	④	⑤	⑥	⑦
	WING STA.	UPPER Pgs.	Z_{UPPER} IN.	$\frac{10^6 A}{Z E a}$ ② 10x4 ③	$10^3 F_{\text{MAX}}$ Pgs 45 THRU 50.	$10^6 F_{\text{MAX}}^2$ ⑤ ²	P_{CRUSH} ④ ⑥
UPPER SURFACE +15, +30, +45 GUSTS	36	533	6.02	.00221	44.5	1980	11.4
	70	423	5.94	.00177	57.8	3340	5.9
	120	311	4.74	.00164	53.0	2810	4.6
	312	241	2.42	.00214	34.1	1160	2.5
	430	241	1.65	.00555	5.5	30	0.1
DOWNER SURFACE -15 Fps GUST	36	706	4.00	.00441	194	377	1.8
	70						
	120	416	3.01	.00412	30.2	915	3.8
	312	359	2.02	.00443	22.0	484	2.1
	430	359	1.11	.00895	3.2	10	0.1

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NORMAL LOADS (CONT'D.)AIR PRESSURE

TYPICAL CHORDWISE PRESSURE DISTRIBUTIONS ARE ESTIMATED FROM NACA TN 3162 USING THE DATA FOR THE 64A410 AIRFOIL WHICH CLOSELY APPROXIMATES THE INBOARD SECTIONS OF THIS WING (64A402). TWO CRITICAL CONDITIONS ARE PRESENTED, +30 FPS GUST @ V_0 AND +15 FPS GUST @ V_0 .

+30 FPS GUST CONDITION

$$\left. \begin{aligned} V_0 &= 150 \text{ kn.}, M = .37 \\ W &= 17192 \text{ #}, S = 600 \text{ ft}^2 \\ q &= (150)^2 / 295 = 76 \text{ psf} \\ n_z &= 3.02 \\ P_{ET} &= 500 \text{ #} \end{aligned} \right\} \begin{aligned} &\text{LR 11055, Pg. 5.06} \\ &\text{LR 11055, Pg. 6.04} \end{aligned}$$

$$C_{LW} = \frac{3.02 \times 17192 + 500}{76 \times 600}$$

$$= 1.15$$

$$\alpha_0 = 10^\circ$$

NACA TN 3162, FIG. 4

+15 FPS GUST CONDITION

$$\left. \begin{aligned} V_0 &= 260 \text{ kn.}, M = .37 \\ W &= 17192 \text{ #}, S = 600 \text{ ft}^2 \\ q &= (260)^2 / 295 = 229 \text{ psf} \\ n_z &= 3.28 \\ P_{ET} &= 2250 \text{ #} \end{aligned} \right\} \begin{aligned} &\text{LR 11055, Pg. 5.06} \\ &\text{LR 11055, Pg. 6.04} \end{aligned}$$

$$C_{LW} = \frac{3.28 \times 17192 + 2250}{229 \times 600}$$

$$= .43$$

$$\alpha_0 = 0^\circ$$

NACA TN 3162, FIG. 4

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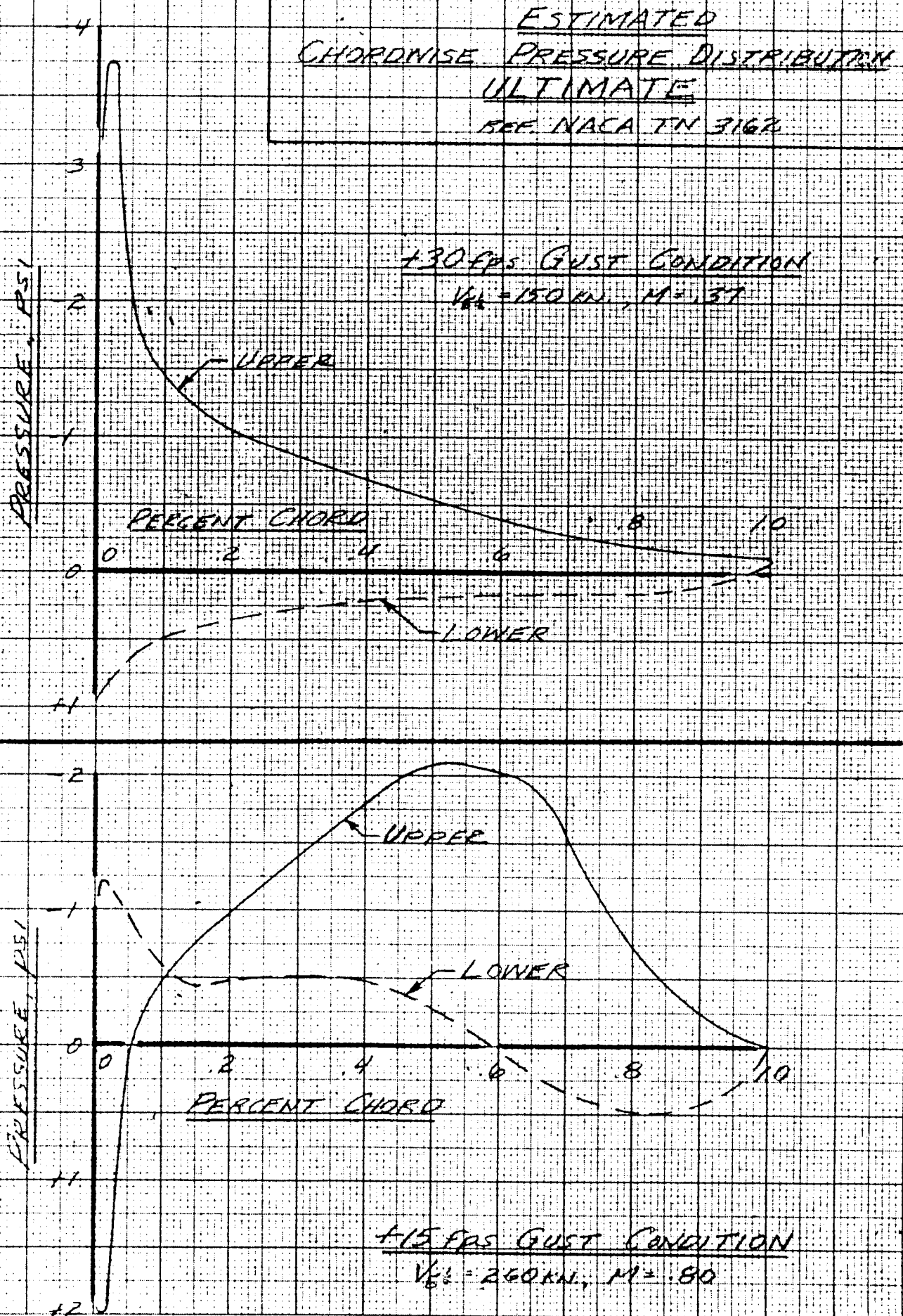
NORMAL LOADS (CONT'D.)
AIR PRESSURE (CONT'D.)

+30 FPS GUST CONDITION

①	②	③	④	⑤	⑥
%C	UPPER ΔP q TN 3162	LOWER ΔP q FIG. 14	q PSI	PAIR U ULT. 1.5(4)(2)	PAIR L ULT. 1.5(4)(3)
.02	-4.70	+1.0	.53	-3.74	+ .80
.05	-2.50	0.8	↑	-1.99	.64
.10	-1.85	0.6	↑	-1.47	.48
.20	-1.30	0.45	↑	-1.03	.36
.40	-0.85	0.25	↑	-.68	.20
.60	-0.50	0.20	↑	-.40	.16
.80	-0.25	+0.20	↓	-.20	+ .16
1.00	-0.15	-0.10	.53	-.12	-.08

+15 FPS GUST CONDITION

①	②	③	④	⑤	⑥
%C	UPPER ΔP q TN 3162	LOWER ΔP q FIG. 14	q PSI	PAIR U 1.5(4)(2)	PAIR L 1.5(4)(3)
.02	+0.50	-0.50	1.54	+1.91	-1.19
.05	+2.05	-1.45	↑	+ .12	-.16
.10	-0.20	-0.25	↑	-.43	-.60
.20	-0.40	-0.20	↑	-.76	-.43
.40	-0.75	-0.20	↑	-1.77	-.43
.60	-0.35	0	↑	-2.02	0
.80	-0.30	+0.20	↓	-.72	+ .43
1.00	0	+0.10	1.54	0	+ .24



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			WING	L185	
Approved				Report No.	11056

UPPER SURFACE - UD - BENDING (REF. DWG. W-7)

STABILITY

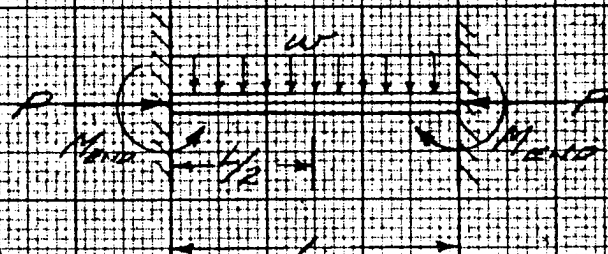
ROW	STATION	36	70	180	312	124 (INTERP.)
ITEM						
1	AXIAL LOAD (Pgs. 45-50)	-23700	-24460	-16630	-8230	-20000
2	SHEAR FLOW (Pgs. 56-59)	-565	-565	-410	+326	-490
3	CRITICAL CONDITION	← +15fps GUST →			+30fps GUST	+15fps
4	STRGR. AREA, A_e (Pgs. 25-31)	.533	.423	.311	.242	.329
5	STRGR. I_e (Pgs. 25-31)	.170	.141	.129	.0257	.130
6	$P_e = (\frac{5}{4})^{1/2}$	.564	.576	.645	.325	.629
7	RIB SPACING (Pg. 22)	16	18	20	12	18
8	END FIXITY, C	1.5	1.5	1.5	1.5	1.5
9	$L/P_e = \frac{7}{6} \sqrt{8}$	23.2	25.5	25.3	30.1	23.4
10	F_{e0} (SM B3)	71600	70500	70600	68200	71500
11	SKIN THICKNESS (Pg. 22)	.072	.072	.064	.051	.072
12	* $F_{scr} = F_{su}$	44000				44000
13	$F_c = \frac{1}{4}$	44000	57900	53500	34000	60000
14	$R_c = \frac{3}{10}$	.62	.82	.76	.50	.85
15	$F_s = \frac{2}{11}$	7850	7850	6410	6410	6800
16	$R_s = \frac{5}{12}$	.18	.18	.15	.15	.16
17	$M.S. = \frac{1}{(14)^2 + (16)^2}^{1/2} - 1$	+1.55	+1.19	+1.29	+1.92	+1.15

* NOTE: FROM PRELIMINARY ANALYSIS IT HAS BEEN DETERMINED THAT $F_{scr} \geq F_{su}$ FOR PRIMARY STABILITY OF ALL UPPER SURFACE SKIN AND STRINGER PANELS.

BEAM COLUMN MOMENT COEFFICIENTS

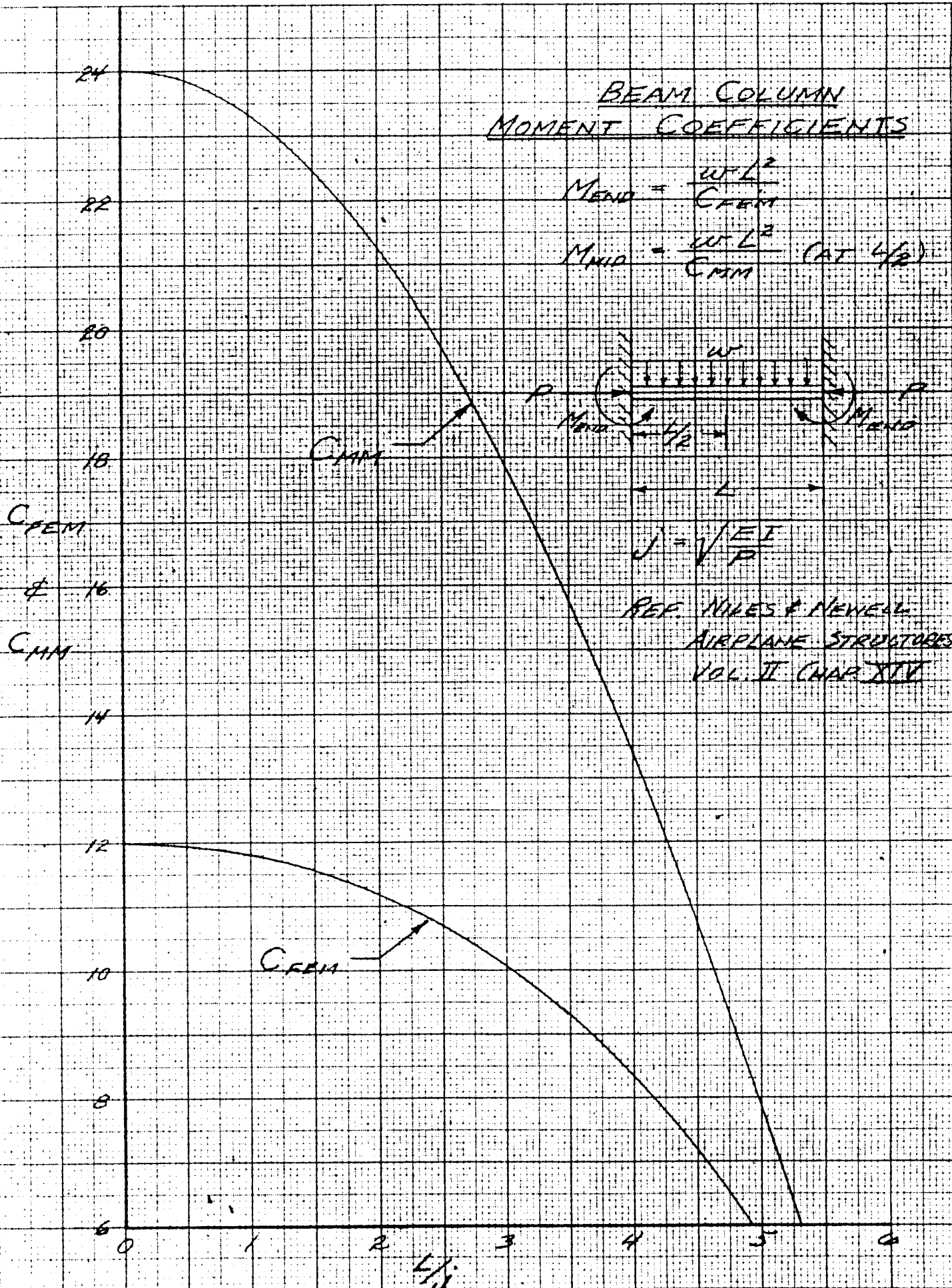
$$M_{END} = \frac{wL^2}{C_{EM}}$$

$$M_{MID} = \frac{wL^2}{C_{MM}} \quad (\text{AT } L/2)$$



$$J = \sqrt{\frac{EI}{P}}$$

REF. NILES & NEWELL
 AIRPLANE STRUCTURES
 VOL. II CHAP. XIV



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Approved					Report No. 11056		

UPPER SURFACE - UP - BENDING (REF DWG. W-7)
LOCAL INTERACTION (CRITICAL AT MID SPANS)

ROW	STATION ITEM	43	58	79	190	318	115 (INTERP.)
1	P AXIAL (PGS. 45-50)	-23800	-24200	-24460	-16630	-8230	-20000
2	Q MAX (PGS. 56-59)	-565	-565	-565	-410	+326	-490
3	P AIR (PG. 67)	+2.1	+2.1	+2.1	+2.1	+1.2	+2.1
4	P CRUSH (PG. 64)	-4.4	-5.9	-5.9	-4.6	-2.5	-5.2
5	P FUEL (PG. 63)	+14.6	+14.5	+14.5	+12.8	+8.2	+13.6
6	CRITICAL CONDITION	←	+15 FPS	GUST	→	+30 FPS	+15 FPS
7	Ae	.533	.533	.423	.311	.242	.329
8	Ie	.170	.170	.141	.129	.0257	.130
9	J SKIN (PGS 25-31)	.428	.428	.563	.589	.210	.553
10	J CAP	1.132	1.132	.997	.971	.790	1.007
11	t SKIN	.072	.072	.072	.064	.051	.072
12	RIB SPACING (R. 22)	16	18	18	20	12	18
13	$f_c = \frac{1}{7}$	-44700	-45400	-57900	-53500	-34000	-60000
14	$j = \sqrt{\frac{10^7 \times 8}{1}}$	8.45	8.38	7.59	8.80	5.59	8.05
15	$4/j = \frac{12}{14}$	1.90	2.15	2.37	2.27	2.16	2.24
16	GMM (PG. 69)	21.5	20.8	20.0	20.4	20.7	20.5
17	$PE = \pi^2 \frac{8 \times 10^7}{12^2}$	65500	51800	42900	31800	17600	39500
18	$K_A = \frac{1}{1 - \frac{1}{1}}$	1.57	1.88	2.32	2.10	1.88	2.08
19	e (CENTRAL ECCENT.)	-140	+045	0	0	0	0
20	$M'_e = L \times e$	-5230	+2040	0	0	0	0
21	$M'_{IN} = 4(3+4)$	-9.2	-15.2	-15.2	-10.0	-5.2	-12.4
22	$M'_{OUT} = 4(3+4+5)$	+49.2	+42.8	+42.8	+41.2	+27.6	+42.0
23	$M'_{IN} = \frac{21 \times 12^2}{6}$	-110	-240	-250	-200	-36	-190
24	$M'_{OUT} = \frac{21 \times 12^2}{6}$	+590	+670	+700	+810	+192	+660
25	$f'_b = -\frac{(20+24) \times 1}{8}$	+30400	-18000	-5000	-6100	-5900	-5000
26	F_{CC} (PGS. 25-31)	65000	65000	65000	65000	49000	65000
27	$M.S. = \frac{(20)(13+8)}{1}$	LARGE	+0.2	+0.3	+0.9	+2.3	+0.0
28	$f'_b = \frac{(20+24) \times 1}{8}$	73400	+4500	-1000	-900	-300	-800
29	F_{CC} (PGS. 25-31)	65000	65000	65000	65000	48000	65000
30	$R_c = \frac{(3+29)}{29}$	.89	.63	.91	.84	.72	.94
31	$R_s = \frac{2}{4 \times 1000 \times 1}$	.18	.18	.18	.15	.15	.16
32	$M.S. = \frac{3 \times 12^2 + 11^2 - 1}{1}$	+1.0	+5.2	+2.5	+1.7	+3.6	+0.5

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LOWER SURFACE - UP BENDING (REF. DWG. W-6)
LOCAL INTERACTION (CRITICAL AT RIBS)

ROW	STATION ITEM	52	70	180	312	124 (INTERP.)
1	PAXIAL (Pg. 45-50)	35500	31488	24185	13158	28350
2	Q MAX. (Pg. 56-59)	-524	-524	+467	+310	-455
3	PAIR (Pg. 67)	+1.5	+1.5	-1.2	-1.2	+1.5
4	P CRUSA (Pg. 64)	-4.4	-5.9	-4.6	-2.5	-5.2
5	P FUEL (Pg. 63)	+14.6	+14.5	+12.2	+8.2	+13.7
6	CRITICAL CONDITION	+15FPS	+15FPS	+30FPS	+30FPS	+15FPS
7	A	.739	.689	.573	.461	.621
8	I	.117	.115	.100	.032	.103
9	Y SKIN } (Pg. 32-36)	.270	.281	.261	.150	.248
10	Y CAP	1.202	1.191	1.203	.909	1.224
11	t SKIN }	.012	.072	.064	.851	.072
12	RIB SPACING (Pg. 23)	16	18	20	12	18
13	ATTACH. THRU SKIN	FLUSH DDG 910	FLUSH DDG 910	FLUSH DDG 910	FLUSH DDG 910	FLUSH DDG 910
14	ATTACH. THRU STRGR	3-DDG	2-AD5 1-DDG	2-AD5 1-DDG	1-AD5 1-DDG	2-AD5 1-DDG
15	N SKIN	.73	.73	.72	.76	.73
16	N SKIN + STRGR.	.77	.74	.75	.81	.75
17	WIN = 6(3+4)	23.4	32.4	28.8	16.2	23.2
18	WOUT = 6(3+4+5)	64.2	54.6	44.4	33.0	54.0
19	MIN = $\frac{1}{12} \frac{1}{12}$	500	875	960	145	760
20	MOUT = $\frac{1}{12} \frac{1}{12}$	1310	1470	1490	396	1460
21	$F_{NET} = \frac{1}{2} \frac{1}{2} + \frac{1}{2} \frac{1}{2}$	76500	77200	7410	48400	73300
22	MATERIAL	←	←	75576	EXTR	→
23	F ₆₀ (AIR-5)	←	←	83000	←	→
24	M/S. = $\frac{1}{2} \frac{1}{2} - 1$	+1.5	+1.07	+1.12	+1.76	+1.06
25	$F_{GROSS} = \frac{1}{2} \frac{1}{2}$	46700	45500	42300	28600	43700
26	$F_B = \frac{1}{2} \frac{1}{2}$	1200	2100	2500	180	1800
27	$F_{NET} = \frac{1}{2} \frac{1}{2}$	67400	63600	62100	39800	65100
28	$F_{NET} = \frac{1}{2} \frac{1}{2}$	10000	10000	10200	3000	8700
29	MATERIAL	←	←	75576	ALL	→
30	$R_t = \frac{1}{2} \frac{1}{2}$	.910	.885	.840	.524	.830
31	$R_s = \frac{1}{2} \frac{1}{2}$	.228	.224	.232	.192	.198
32	M/S. = $\frac{1}{2} \frac{1}{2} - 1$	←	←	←	←	←

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Checked			TITLE WING		Model L185	
Approved					Report No. 11056	

LOWER SURFACE - DOWN BENDING (REF. DWG. W-6)

STABILITY

STATION	ITEM	36	180	312	430
1	AXIAL LOAD (Pgs. 45-50)	-20500	-15250	-9220	-1150
2	SHEAR FLOW (PRELIM. ANAL.)	300	300	150	100
3	CRITICAL CONDITION	← -15fps GUST →			
4	STRGR. AREA, A_e (Pgs. 32-36)	.447	.270	.242	.242
5	STRGR. I_e (Pgs. 32-36)	.109	.0842	.0257	.0257
6	$P_e = (\frac{5}{4})^{1/2}$	.492	.558	.325	.325
7	RIB SPACING (Pg. 23)	16	20	12	10
8	END FIXITY, C	1.5	1.5	1.5	1.5
9	$L'/P_e = \frac{7}{6\sqrt{8}}$	26.6	29.3	30.2	25.1
10	F_{c0} (SM B3)	70000	68500	68000	70700
11	SKIN THICKNESS (Pg. 23)	.072	.064	.051	.051
12	* F_{SCR}	44000	34600	42000	42000
13	$f_c = \frac{L}{14}$	45100	56500	38100	4800
14	$R_c = \frac{1}{10}$	.655	.525	.561	.068
15	$F_S = \frac{R}{14}$	4200	4700	3000	2000
16	$R_S = \frac{1}{10}$	.076	.136	.072	.149
17	$M.S. = \frac{1}{(\frac{1}{4} + \frac{1}{10})^{1/2}} - 1$	1.51	1.20	1.76	2.00E

* NOTE: CRITICAL SHEAR STRESS FOR GENERAL STABILITY FROM PRELIMINARY ANALYSIS BY THE METHOD OF TIMOSHENKO'S "THEORY OF ELASTIC STABILITY".

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		1-26-56	CALIFORNIA DIVISION	67	115
Checked			TITLE	Model L 185	
			WING		
Approved				Report No. 11056	

LOWER SURFACE - DOWN BENDING

LOCAL INTERACTION (CRITICAL AT RIBS)

ROW	STATION	43	190	318	425		
ITEM							
1	PAIAL (PGS. 45-50)	-20500	-15250	-9220	-1150		
2	q MAX (PRELIM. ANAL.)	300	300	150	100		
3	PAIR (USE U.S. PG. 67)	+2.1	+2.1	+2.1	+2.1		
4	p CRUSH (PG. 64)	-1.8	-3.8	-2.1	-0.1		
5	p FUEL (RATIO +15 FPS)	+6.1	+5.5	+4.2	+2.2		
6	CRITICAL CONDITION	←	-15fps	GUST	→		
7	Ae	447	270	242	242		
8	Ie	109	0842	0257	0257		
9	J SKIN	341	444	210	210		
10	J CAP	1.024	921	790	790		
11	t SKIN	.072	.064	.051	.051		
12	RIB SPACING (PG. 23)	16	20	12	10		
13	F _c = (1/2)	-45800	-56500	-38200	-4750		
14	J = $\sqrt{10^6 E / L}$	7.30	7.43	5.07	14.9		
15	L/J = (1/2)	2.19	2.69	2.37	.67		
16	CMM (PG. 69)	20.7	19.0	20.1	23.7		
17	M _{MIN} = 6(4)	-10.8	-22.8	-12.6	-0.6		
18	M _{MAX} = 6(3) + 4(5)	+38.4	+22.8	+25.2	+25.2		
19	M _{MIN} = (1) 12 / 16	-134	-430	-70	-3		
20	M _{MAX} = (8) 12 / 16	+415	+430	+180	+106		
21	F _b ' = -20 10 / 8	-4500	-5300	-5500	-3300		
22	F _{cc} (PG. 32-36)	62000	62000	4900	41000		
23	M.S. = $\left[\frac{22}{(13+1)} \right] - 1$	+1.23	+1.00	+1.12	+1.00		
24	F _b ' = (14) 1 / 8	-400	-2500	-700	0		
25	F _{cc} (PG. 32-36)	65000	63000	4800	48000		
26	R _c = (13 + 1) / (23)	.711	.908	.811	.099		
27	R _s = (2) / 44000 (1)	.095	.107	.067	.045		
28	M.S. (26 + 1) = 1	+1.39	+1.09	+1.22	+1.00		

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CHORDWISE SPLICES

CHORDWISE SPLICES ARE LOCATED AT WING STATIONS 160 AND 300. AT STATION 160, ONLY THE SKIN IS SPLICED AND STRINGERS ARE CONTINUOUS. IN THE REGION OF THIS SKIN SPlice THE STRINGERS ARE REINFORCED IN AREA TO ALLOW FOR OVERLOAD DUE TO SKIN SPlice DEFLECTIONS.

STRINGERS AND SKIN ARE BOTH SPLICED AT WING STATION 300. THE UPPER AFT REMOVABLE PANEL ENDS AT THIS STATION IN A SHEAR TYPE JOINT. THE JOINT IS DESIGNED WITH LOW BEARING PRESSURES IN ORDER TO APPROXIMATE THE STIFFNESS OF THE SPLICED FORWARD PANEL AND HENCE IS NOT CRITICAL.

STA. 160+ UPPER (REF DWG. IV-7, SHT. 1)

SKIN SPlice: .064 753TG ALCL.

LOADS: +15fps GUST CONDITION (USE STA 180 LOAD)

$$P_c = 16630 \text{ LBS.} \quad (\text{Pg. 48})$$

$$Q = 410 \text{ LBS/IN} \quad (\text{Pg. 57})$$

$$\left. \begin{array}{l} A_{\text{FLANGE}} = .311 \text{ IN.}^2 \\ A_{\text{SKIN}} = .290 \text{ IN.}^2 \end{array} \right\} \quad (\text{Pg. 30})$$

$$\text{STRINGER SPACING} = 4 \text{ IN.}$$

DIAGONAL TENSION EFFECTS ARE RELIEVED AND CONSERVATIVELY NEGLECTED.

$$P_{\text{SKIN}} = 16630 \times \frac{.092}{.311} = 4820 \text{ LBS.}$$

$$P_{\text{S SKIN}} = 4 \times 410 = 1640 \text{ LBS.}$$

$$P_R = 4820 + 1640 = 5100 \text{ LBS.}$$

ATTACH. 4 ROWS OR 4 RIVETS, DDG FLUSH IN .064.

$$P_{\text{ATTACH}} = 16 \times 896 = 14200 \text{ LBS.} \quad (\text{SM 173})$$

$$M.S. \text{ ATTACH} = \frac{14200}{5100} - 1 =$$

+ LARGEM

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CHORDWISE SPLICES (CONT'D.)STA. 160+ LOWER (REF. DWG. W-6, SHT. I)

SKIN SPlice: .064 75576 ALCLAD

LOADS: +15 FPS GUST CONDITION (USE STA. 180 LOADS)

$$P_T = 24180 \text{ LBS.} \quad (\text{Pg. 48})$$

$$q = 387 \text{ LBS./IN.} \quad (\text{Pg. 57})$$

$$A_{PLATE} = .573 \text{ IN.}^2 \quad \left. \begin{array}{l} \\ \\ \end{array} \right\} (\text{Pg. 35})$$

$$A_{SKIN} = .384 \text{ IN.}^2$$

STRINGER SPACING = 6 IN.

DIAGONAL TENSION EFFECTS ARE NON-EXISTENT SINCE PRIMARY TENSION STRESS MAKES THE SKIN NON-BUCKLED.

$$P_{SKIN} = 24180 \times \frac{.384}{.573} = 16200 \text{ LBS.}$$

$$P_{SKIN} = 6 \times 387 = 2320 \text{ LBS.}$$

$$P_R = 16200 + 2320 = 16400 \text{ LBS.}$$

ATTACH. 4 ROWS OF 6 RIVETS, DDC FLUSH IN .064

$$P_{BELOW} = 24180 = 21300 \text{ LBS.}$$

$$M.S. \text{ ATTACH.} = \frac{21300}{16400} - 1 = +.30 M.$$

$$n_{SKIN} = 1 - \frac{.01777}{.064 \times 1.0} = .72 \quad (\text{SM 56})$$

$$\left. \begin{array}{l} F_{60} = 74000 \text{ PSI} \\ F_{50} = 44000 \text{ PSI} \end{array} \right\} (\text{ANC-5})$$

$$R_T = \frac{16200}{.384 \times 74000 \times .72} = .794$$

$$R_S = \frac{2320}{.384 \times 44000 \times .72} = .191$$

$$M.S. \text{ NET SECTION} = \frac{1}{(.794^2 + .191^2)^{1/2}} - 1 = +.22 M.$$

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LONGWISE SPLICES (CONT'D.)STA. 300 + UPPER (REF. DWG W-7, SHT. 2)LOADS: +30 FPS GUST CONDITION (USE STA 312 (MAX))

$$P_c = 8230 \text{ LBS.} \quad (\text{Pg. 49})$$

$$Q = 326 \text{ LBS./IN.} \quad (\text{Pg. 5B})$$

$$A_{\text{FLANGE}} = .242 \text{ IN.}^2$$

$$A_{\text{SKIN}} = .087 \text{ IN.}^2$$

$$A_{\text{STRINGER}} = .155 \text{ IN.}^2 \quad (\text{Pg. 31})$$

$$\text{STRINGER SPACING} = 4 \text{ IN.}$$

STRINGER SPLICE:

$$F_{scr} = R_s K_s E \left(\frac{t}{b} \right)^2$$

WHERE:

$R_s = .25$ CONSERVATIVE ESTIMATE
OF EFFECT OF PRIMARY
COMPRESSION.

$$K_s = 4.84$$

$$E = 10^7 \text{ PSI}$$

$$t = .051 \quad (\text{75576 ALG.})$$

$$b = 4.0$$

$$\therefore F_{scr} = .25 \times 4.84 \times 10^7 \left(\frac{.051}{4} \right)^2 = 197 \text{ PSI}$$

$$Q_{scr} = .051 \times 1970 = 100 \text{ #/IN.}$$

$$Q_{D.T.} = 326 - 100 = 226 \text{ #/IN.}$$

$$\Delta P_c = 226 \times 4 = 900 \text{ LBS.}$$

$$P_c + \Delta P_c = 8230 + 900 = 9130 \text{ LBS.}$$

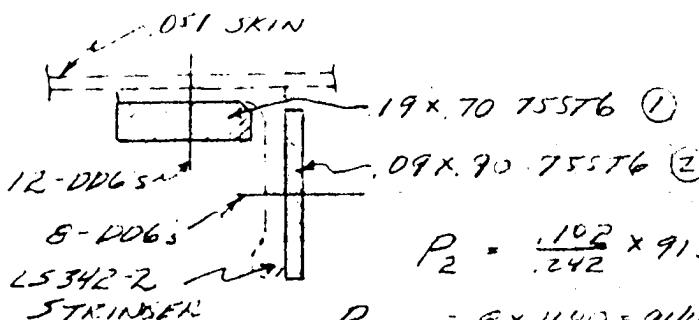
$$P_1 = \frac{140}{.242} \times 9130 = 5290 \text{ LBS.}$$

$$P_{allow,1} = 12 \times 1180 = 14200 \text{ LBS.}$$

$$M.S. \textcircled{1} = \frac{14200}{5290} - 1 = + \text{LARGE M.}$$

$$P_2 = \frac{102}{.242} \times 9130 = 3950 \text{ LBS.}$$

$$P_{allow,2} = 8 \times 1180 = 9440 \text{ LBS.}, \quad M.S. \textcircled{2} = \frac{9440}{3950} - 1 = + \text{LARGE M.}$$



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CHORDWISE SPICES (CONT'D.)STA 300+ UPPER (CONT'D.)

SKIN SPICE: SIMILAR TO STA. 300 LOWER
BUT LESS CRITICAL.

STA. 300+ LOWER (REF DWG. W-6 SHEET 2)

LOADS: +30fps GUST CONDITION (USE STA. 312 LOADS)

$$P_T = +13160 \text{ LBS} \quad (\text{Pg. 49})$$

$$Q = 310 \text{ LBS/IN.} \quad (\text{Pg. 58})$$

$$\left. \begin{aligned} A_{FLANGE} &= .461 \text{ IN.}^2 \\ A_{SKIN} &= .306 \text{ IN.}^2 \\ A_{STRG} &= .155 \text{ IN.}^2 \end{aligned} \right\} \quad (\text{Pg. 36})$$

STRINGER SPACING = 6 IN.

STRINGER SPICE: SIMILAR TO STA. 300 - UPPER
BUT LESS CRITICAL.

SKIN SPICE:

$$P_{SKIN} = \frac{.306}{.461} \times 13160 = 8740 \text{ LBS.}$$

$$P_{STRG} = 6 \times 310 = 1860 \text{ LBS.}$$

$$P_R = 8740 + 1860 = 8950 \text{ LBS.}$$

ATTACH. - 3 ROWS OF 7 RIVETS, DUG FLUSH IN .051.

$$P_{ALLOW} = 21 \times 758 = 15900 \text{ LBS.}$$

$$M.S. \text{ ATTACH.} = \frac{15900}{8950} - 1 = +.76 \text{ MS}$$

$$n_{SKIN} = 1 - \frac{.01495}{.051 \times .86} = .66$$

$$R_t = \frac{8740}{.306 \times 7700 \times .86} = .585$$

$$R_s = \frac{310}{.051 \times 4400 \times .86} = .210$$

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SPANWISE SPLICESUPPER SURFACE (REF. DRWG. W-7)

SINCE THE UPPER SURFACE PANELS ARE REMOVABLE, NAS 517-3 (3/16 DIA) FLUSH SCREWS ARE USED THROUGHOUT AT A TYPICAL SPACING OF 1.0 IN. THE CRITICAL MARGIN OF SAFETY OCCURS AT THE 15% CAP BETWEEN STATION 36 AND STATION 70 WHERE SHEAR LAG EFFECTS DUE TO LEADING EDGE STRINGERS A, B, C AND D ADD TO THE SHELL BASIC SHEAR FLOW.

15% CAP, STA. 36 → 70 (0.1275 STG. ALG. SKIN)
 NAS 517-3 (3/16) FLUSH SCREWS @ 1.0 $\eta = 1 - \frac{.02116}{.072} = .70$
 + 30 FPS GUST CONDITION

$$q_{\text{BASIC}} = 390 \text{ LBS/IN. (Pg. 56)}$$

$$P_a + P_b + P_c + P_d = 14418 \text{ LBS (Pg. 47)}$$

$$q_{\text{SLAG}} = \frac{14418}{70-36} = 424 \text{ LBS/IN.}$$

$$q_{\text{TOTAL}} = 390 + 424 = 814 \text{ LBS/IN.}$$

STRINGER SPACING, $b = 4.0 \text{ in.}$

$$F_{\text{SCR}} = .25 \times 4.84 \times 10^7 \left(\frac{.072}{4} \right)^2 = 3920 \text{ PSI (REF Pg. 76)}$$

$$q_{\text{CR}} = 3920 \times .072 = 282 \text{ LBS/IN.}$$

$$q_{\text{D.T.}} = 814 - 282 = 532 \text{ LBS/IN.}$$

$$q_{\text{R}} = 814 \rightarrow 532 = 974 \text{ LBS/IN.}$$

$$q_{\text{ACTION}} = \frac{1.5 \times 894}{1.0} = 1325 \text{ LBS/IN. (SM 73)}$$

$$M_{\text{ATTACH.}} = \frac{1325}{974} - 1 = + .36 \text{ MS.}$$

$$R_s = \frac{814}{.372 \times 4400 \times .70} = .37$$

$$R_T = \frac{532}{.072 \times 7400 \times .70} = .15$$

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SPANNWISE SPLICES (CONT'D)LOWER SURFACE (REF. DWG. IV-6)

DUE TO PRESENT TENSION STRESS, THE LOWER SURFACE REMAINS UNBUCKLED AT THE SHEAR FLOW MAGNITUDES EXISTENT.

STA 36 → 160

$q_{max} = 524 \text{ LBS./IN.}$ (REF. Pg. 56)
FROM +15 FPS GUST CONDITION AT 48% SPLICE

ATTACH. BY DDG RIVETS FLUSH IN
D72 755TG ALLRAD AT .62 IN. SPACING

$$q_{allow} = \frac{942}{.62} = 1500 \text{ LBS./IN. (SM 13)}$$

$$M.S. = \frac{1500}{524} - 1 =$$

+ LARGE M.S.STA 160 → 300

$q_{max} = 467 \text{ LBS./IN.}$ (REF. Pg. 57)
FROM +30 FPS GUST CONDITION AT 15% SPLICE

ATTACH BY DDG RIVETS FLUSH IN
D64 755TG ALLRAD AT .67 IN. SPACING

$$q_{allow} = \frac{886}{.67} = 1325 \text{ LBS./IN. (SM 13)}$$

$$M.S. = \frac{1325}{467} - 1 =$$

+ LARGE M.S.STA 300 → 440

$q_{max} = 310 \text{ LBS./IN.}$ (REF. Pg. 58)

$$q_{allow} = \frac{752}{.70} = 1080 \text{ LBS./IN.}$$

$$M.S. = \frac{1080}{310} - 1 =$$

+ LARGE M.S.

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WING TO FUSELAGE JOINT (REF. DWG. W-5)

THE WING TO FUSELAGE JOINT CONSISTS OF AN EXTENDED WELDED SHAPED BAR WHICH IS SANDWICHED BETWEEN THE WING SKIN AND STRINGERS AND HAVING BLIND NUTS FOR FUSELAGE ATTACHING BOLTS. SEE SKETCHES PAGE 81 AND 84.

CRITICAL LOADS OCCUR IN THE ± 15 FPS GUST CONDITIONS AT V_D . (REF. PG. 45)

± 15 FPS GUST @ V_D
(UP BENDING)

$$P_{\text{UPPER}} = 71000^{\#}$$

$$P_{\text{BOLT}} = \frac{71000}{2} = 35500^{\#}$$

$$P_{\text{UPPER STAGE}} = -\frac{71000}{3} = -23700^{\#}$$

$$P_{\text{LOWER STAGE}} = +\frac{71000}{2} = +35500^{\#}$$

-15 FPS GUST
(DOWN BENDING)

$$41000^{\#}$$

$$20500^{\#}$$

$$+13700^{\#}$$

$$-20500^{\#}$$

JOINT FITTINGS

UPPER LS6001, LOWER LS6002

MATERIAL 753T6 EXTR. $25 \leq E \leq 1.499$

MIN. GUARANTEE PROPERTIES:

$$F_{\text{BU}} \geq 80000 \text{ PSI}$$

$$T \geq 69000 \text{ "}$$

$$F_{\text{LY}} \geq 72000 \text{ "}$$

$$T \geq 58000 \text{ "}$$

$$F_{\text{CY}} \geq 72000 \text{ "}$$

$$T \geq 65000 \text{ "}$$

$$F_{\text{SU}} \geq 44000 \text{ "}$$

$$F_{\text{BU}} \geq 138000 \text{ "}$$

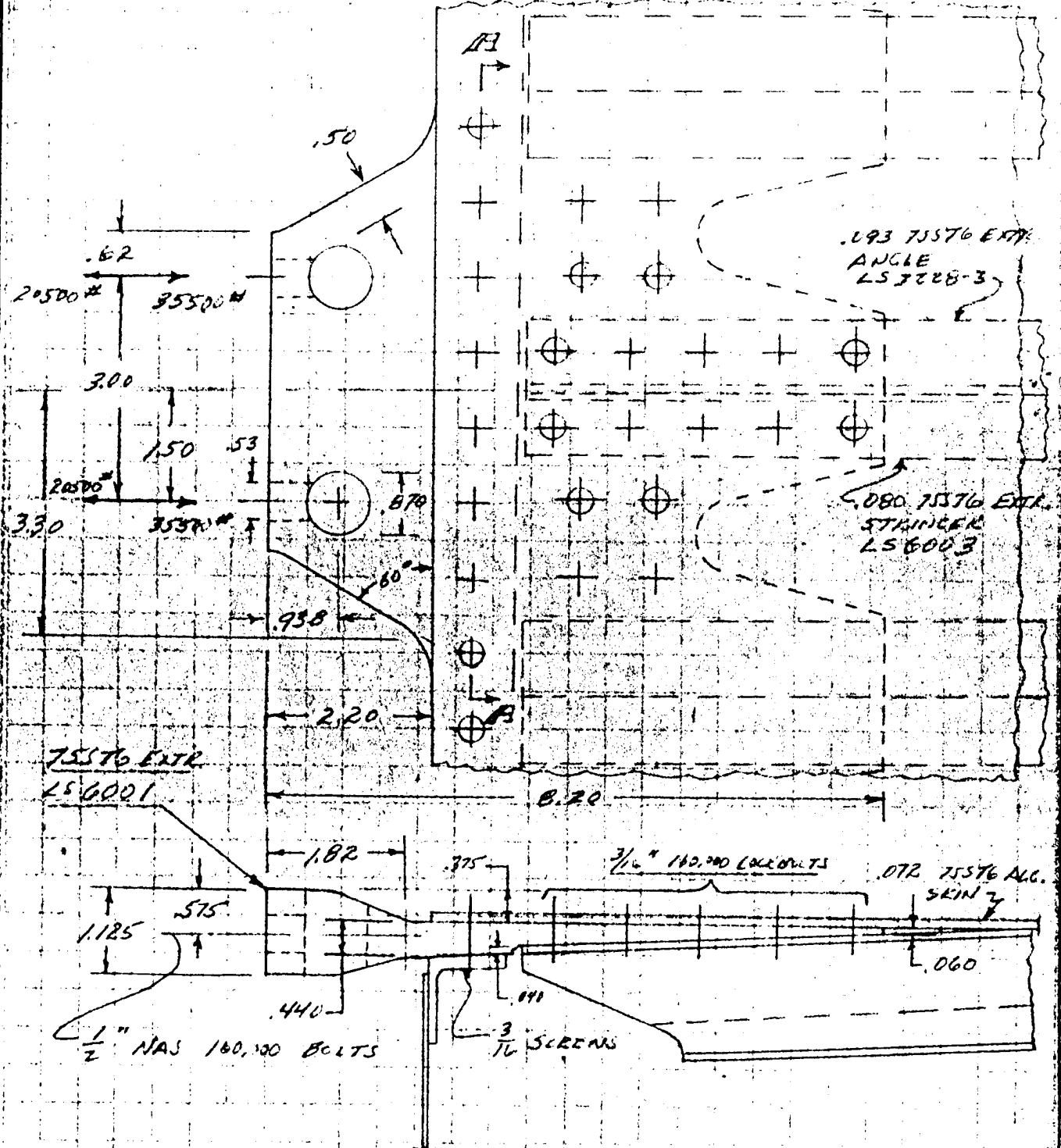
(REF. ANC-5)

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WING - FUSE JOINT (CONT'D.)

UPPER - TECH METAL

SCALE 1" = 2"



REF. DWG. W-5

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WING - FUSE. JOINT (CONT'D)UPPER ANALYSIS1/2" MS BOLT H.T. $\rightarrow 160,000 \text{ PSI}$

$$P = +20500 \text{ LBS. } (-15 \text{ FPS GUST COND.})$$

$$P_{\text{DOWN}} = 23400 \text{ LBS.}$$

$$M.S. = \frac{23400}{20500} - 1 =$$

$$+ .14 \text{ MS.}$$

BARREL NUT LUG REF. SM 10

$$P = +20500 \text{ LBS. } (-15 \text{ FPS GUST COND.})$$

$$a = .94, D = .87, t = 1.105 - .53 = .60$$

$$D/D = 1.08, D/t = 1.45, K_{br} = .95$$

$$P_{br} = .95 \times 69000 \times .87 \times .60 = 34200 \text{ LBS.}$$

$$W/D = 2.16, K_e = .96$$

$$P_{br} = .96 \times 69000 \times 1.00 \times .60 = 39700 \text{ LBS.}$$

$$M.S. \text{ SHE-BEG. } = \frac{34200}{21500} - 1 =$$

$$+ .66 \text{ MS.}$$

SEC A. A

$$P = 71000 \text{ LBS. COMP. } (+15 \text{ FPS GUST COND.})$$

$$e = .06 \text{ IN. (ASSUMED ECCENTRICITY)}$$

$$M = .06 \times 71000 = 4260 \text{ IN. LBS.}$$

$$F_c = \frac{71000}{7 \times .4} + \frac{4260 \times 6}{7 (.4)^2}$$

$$= 25400 + 22800 = 48200 \text{ PSI}$$

$$F_{cu} = F_{cu} = 69000 \text{ PSI}$$

$$M.S. = \frac{69000}{48200} - 1 =$$

$$+ .43 \text{ MS.}$$

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WING - FUEL JOINT (CONT'D.)UPPER - ANALYSIS (CONT'D.)ATTACHMENT 1 3/16 LOCKBOLTS (160,000 PSI HT.)

STANCHION LOAD:

$$EFF AREA = .533 \text{ in.}^2 \quad (Pg. 28)$$

$$P_{ANAL} = 23700 \text{ LBS}$$

$$F_c = 23700 / .533 = 45500 \text{ PSI}$$

$$STANCH AREA = .371 \text{ in.}^2$$

$$P_{STANCH} = .371 \times 45500 = 16900 \text{ LBS.}$$

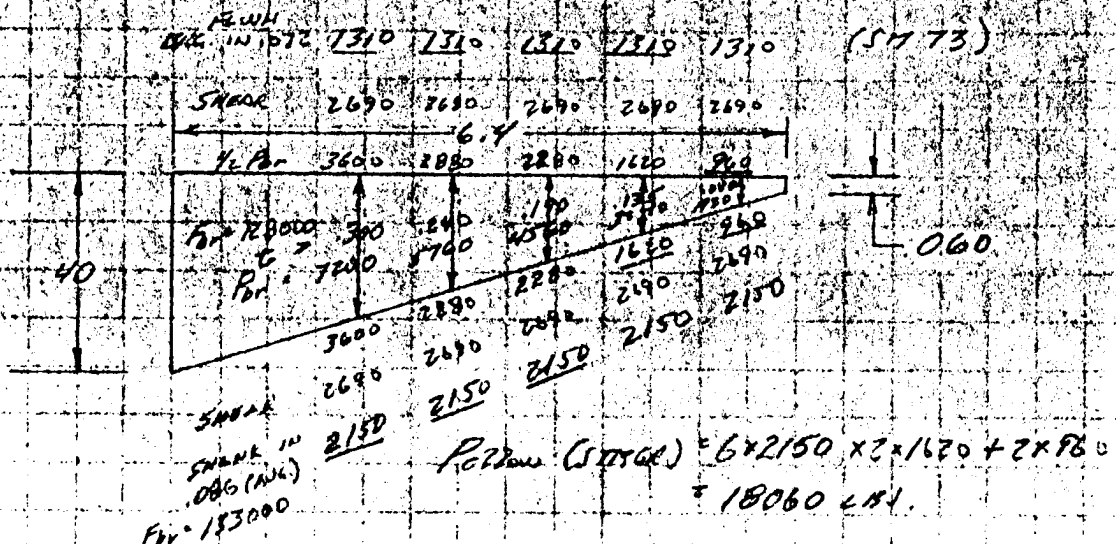
SKIN LOAD:

$$GROSS AREA = .706 \text{ in.}^2 \quad (Pg. 28)$$

$$F_c = 23700 / .706 = 33600 \text{ PSI}$$

$$SKIN AREA = 4 \times .072 = .288 \text{ in.}^2$$

$$P_{SKIN} = .288 \times 33600 = 9700 \text{ LBS.}$$



$$M.S. STANCH. = \frac{18060}{16900} - 1 = +.07 M.S.$$

$$P_{STANCH} (SKIN) = 6 \times 1310 + 2 \times 960 = 12400 \text{ LBS.}$$

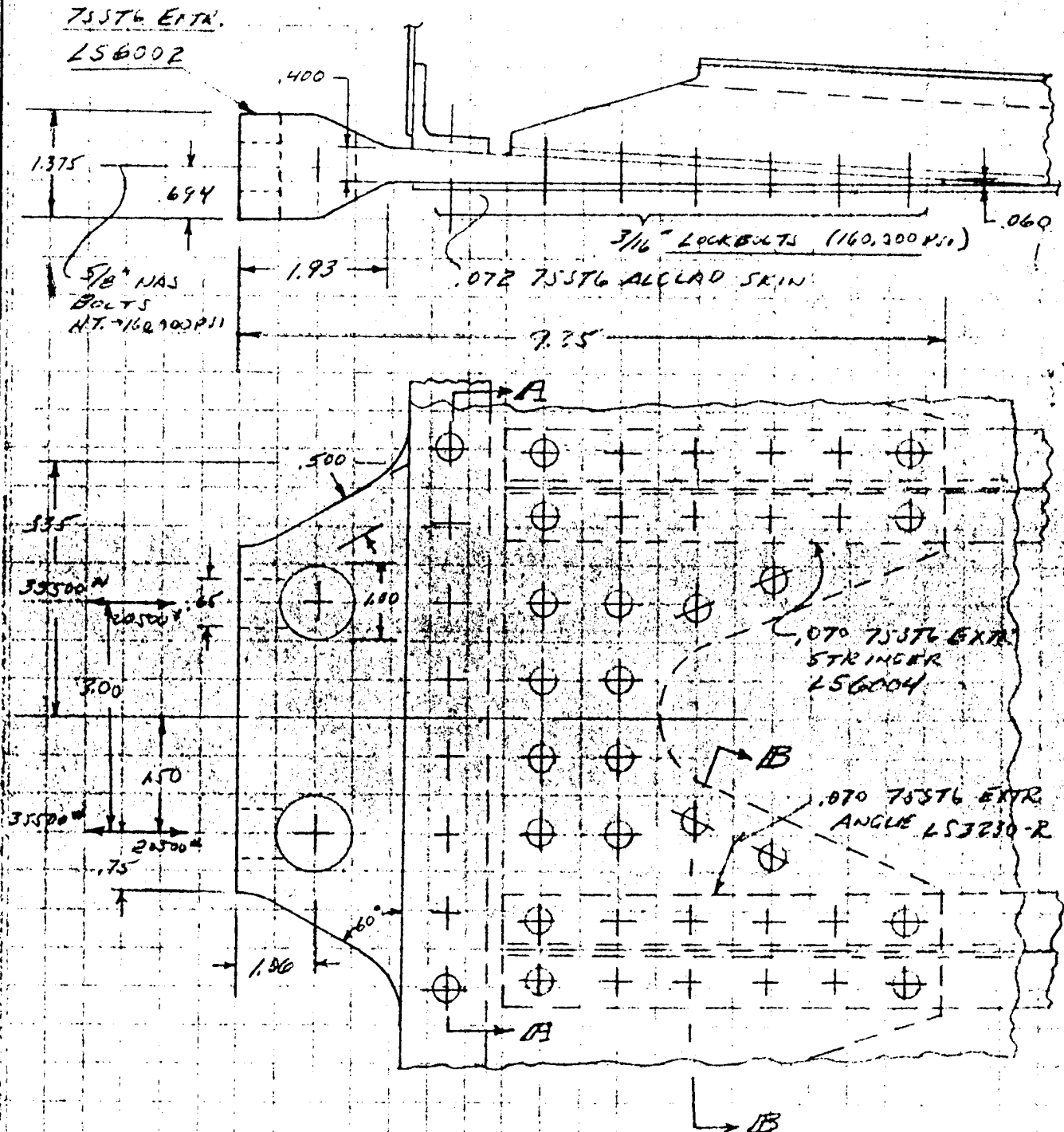
$$M.S. SKIN = \frac{12400}{9700} - 1 = +.28 M.S.$$

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WING-FUSE JOINT (CONT'D)

LOWER GEOMETRY

SCALE: 1"=2"



REF. DWG. W-5

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WING - FUSE. JOINT (CONT'D.)

LOWER ANALYSIS

5/8" MS BOLT H.T. $\rightarrow$ 160,000 PSI

$$P = +35500 \text{ LBS. } (+15 \text{ FPS GUST COND.})$$

$$P_{\text{ALLOW}} = 38000 \text{ LBS.}$$

$$M.S. = \frac{38000}{35500} - 1 =$$

+ .07 M.S.

BARREL NUT LUG REF. SM1c

$$P = +35500 \text{ LBS. } (+15 \text{ FPS GUST COND.})$$

$$a = 1.06, D = 1.00, t = 1.375 - .65 = .725 \text{ in.}$$

$$a/D = 1.06, P/t = 1.38, K_D = .92$$

$$P_{\text{BAR}} = .92 \times 69000 \times 1.00 \times .725 = 46000 \text{ LBS.}$$

$$V/D = 2.12, K_t = .96$$

$$P_{\text{B}} = .96 \times 69000 \times 1.00 \times .725 = 48000 \text{ LBS.}$$

$$M.S. \text{ SHR. BAR.} = \frac{46000}{35500} - 1 =$$

+ .29 M.S.

SEC. II - II

$$P = 71000 \text{ LBS. TENS. } (+15 \text{ FPS. GUST COND.})$$

$$e = .06 \text{ in. (ASSUMED ECCENTRICITY)}$$

$$M = .06 \times 71000 = 4260 \text{ in. LBS.}$$

$$f_t = \frac{71000}{.400(7.00 - 7 \times .19)} + \frac{4260 \times 6}{.400^2(7.00 - 7 \times .19)}$$

$$= 31300 + 28200 = 59500 \text{ PSI}$$

$$F_{\text{BUT}} = 69000 \text{ PSI}$$

$$M.S. \text{ NUT SECTION} = \frac{69000}{59500} - 1 =$$

+ .16 M.S.

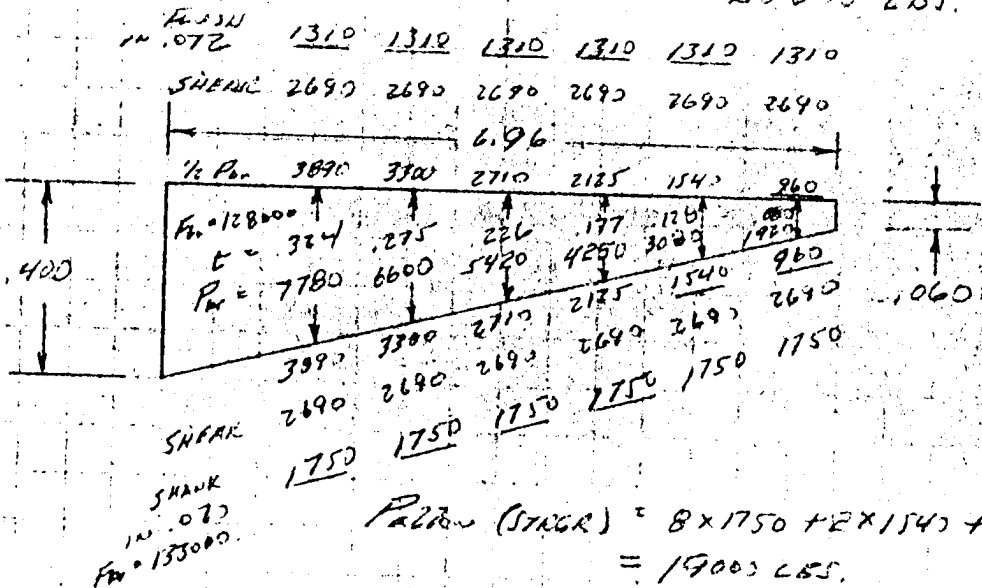
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WING FUSE JOINT (CONT'D.)LOWER ANALYSIS (CONT'D.)ATTACHMENTS 3/16 LOCKETS (16.200 IN. HT.)

STANCHION AREA .187 in.²
 ANGLE AREA .112
 TOTAL .307 in.²
 SKIN AREA (6 X .072) .432
 TOTAL .739 in.² } (Pg. 32)
 $f_t = 35500 / .739 = 48000 \text{ PSI}$

$$P_{\text{PLANER}} = 48000 \times .307 = 14800 \text{ LBS.}$$

$$P_{\text{SKIN}} = 48000 \times .432 = 20800 \text{ LBS.}$$



$$P_{\text{PLANER (STAKE)}} = 8 \times 1750 + 2 \times 1540 + 2 \times 960 = 19000 \text{ LBS.}$$

$$M.S. \text{ STAKE} = \frac{19000}{14800} - 1 = +.28115$$

$$P_{\text{PLANER (SKIN)}} = 20 \times 1310 + 2 \times 960 = 28100 \text{ LBS}$$

$$M.S. \text{ SKIN} = \frac{28100}{20800} - 1 = +.35115$$

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LEADING EDGEDESCRIPTION

THE LEADING EDGE ACTS BOTH AS A BEAM AND A PORTION OF THE TORQUE CELL AND LIES BETWEEN THE BEAM AND 1ST. CHORD LINES. THE STD TIE IS SHOWN SKEWED IN THE SURFACE DRAWINGS FR. 22 AND 23. IT CONSISTS OF AN .040 755TG ALLCLAD MAIN, 755TG EXTENDED STRINGERS AND RIBS OF 755TG AND 2418D ALLCLAD.

SINCE THE LEADING EDGE IS ALSO A PORTION OF THE MAIN FUEL TANK, THE STRINGERS ARE DESIGNED TO CARRY FUEL PRESSURE AS WELL AS AXIAL LOAD, AIRLOADS AND CRUSHING LOADS.

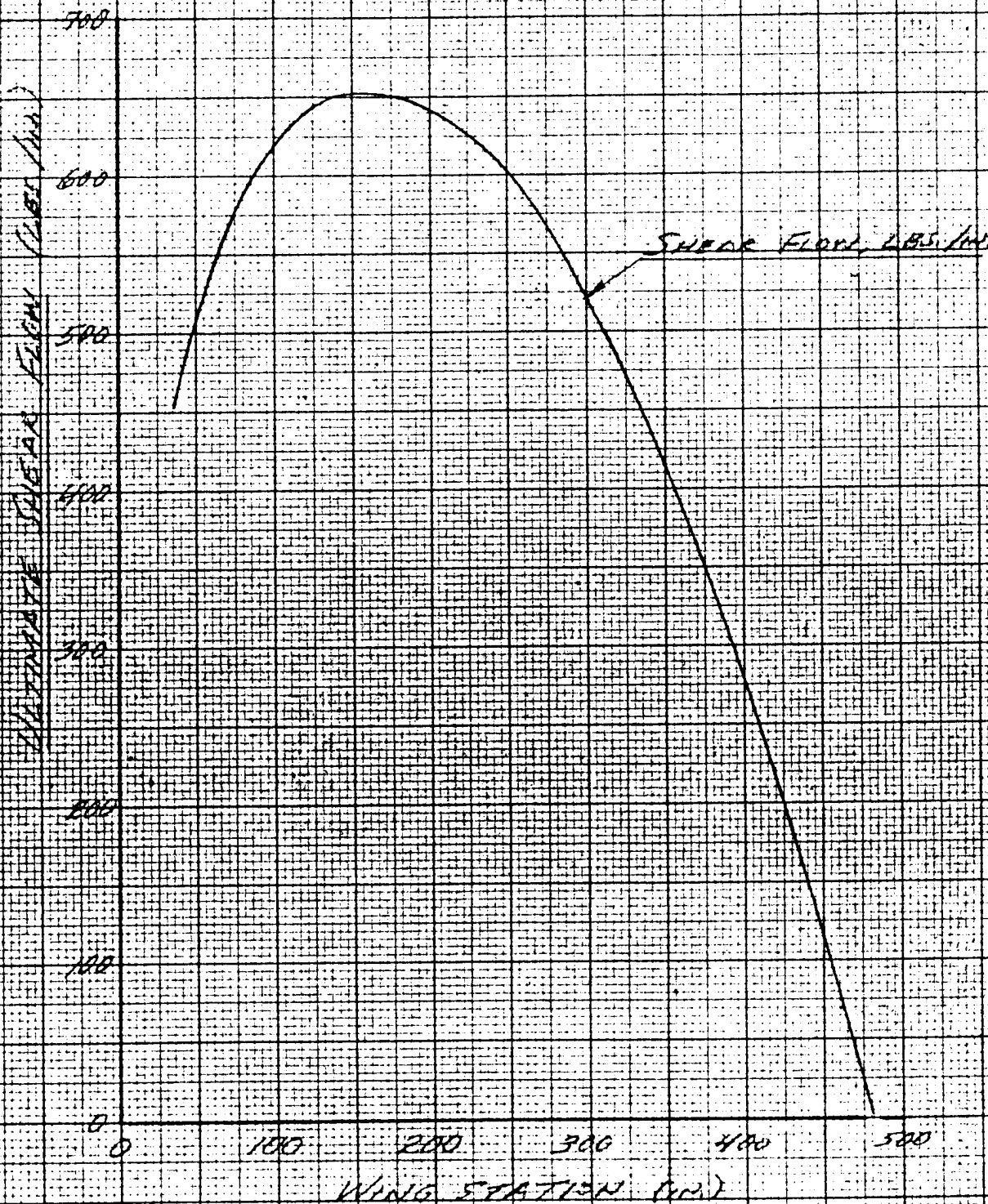
CRITICAL LOADS OCCUR IN THE +30KPI GUST CONDITION AT V_C , WHERE BEAM SHEAR AND POSITIVE TORSION ADD TO PRODUCE MAXIMUM SHEAR IN THE LEADING EDGE. THIS CONDITION HAS BEEN STATIC TESTED TO 100% OF DESIGN ULTIMATE SUCCESSFULLY (REF LR-10571, PG 2-1).

METHOD OF ANALYSIS

CRITICAL MARGINS OF SAFETY OCCUR IN THE NOSE OF THE LEADING EDGE DUE TO COMBINED SHEAR AND COMPRESSION FROM DIAGONAL TENSION AND IN THE UPPER SURFACE STRINGERS DUE TO THE AXIAL LOADS COMBINED WITH AERIAL PRESSURE.

ULTIMATE
LEADING EDGE (NOSE) SHEAR FLOW
+30 FT GUST @ V_L

REF FIG. 36 THRU 59



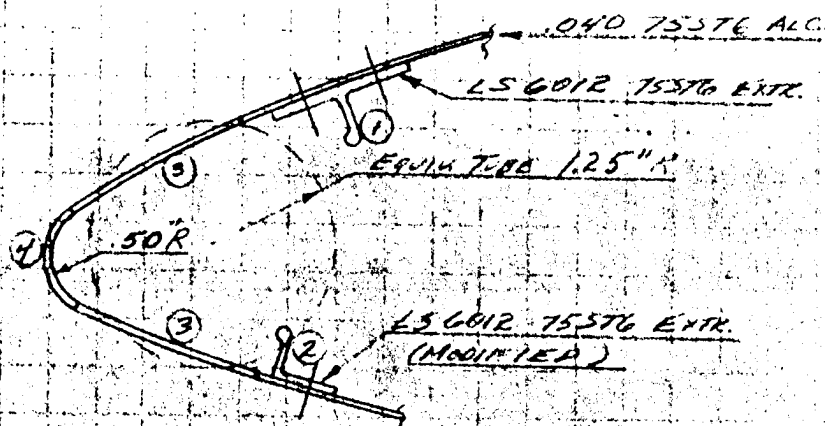
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LEADING EDGE

(REF. DNG. W-2)

NOSE SHEAR @ STA. 170

FAILURE OF THE LEADING EDGE WOULD INVOLVE COLLAPSE OR BUCKLING OF THE NOSE RADIUS UNDER THE COMBINED EFFECTS OF SHEAR AND COMPRESSION DUE TO DIAGONAL TENSION. HENCE THE NOSE RADIUS AND ADJACENT STAINGERS (SHOWN IN SKETCH) ARE CONSIDERED AS A SHORT COLUMN BETWEEN RIBS AND ANALYZED IN COMBINED COMPRESSION AND SHEAR USING THE SQUARED BUCKLING INTERACTION EQUATION, $R_s^2 + R_c^2 = 1$.



MAX. SHEAR FLOW, $q = 650 \text{ LB/IN}$
 CRITICAL CONDITIONS $\sim +30 \text{ PSI}$ (JUST @ V_L) } (Pg. 88)

$$F_s = \frac{650}{.040} = 16250 \text{ PSI}$$

FOR AN EQUIVALENT TUBE, $R = 1.25 \text{ IN.}$

$$D/t = \frac{2.5}{.040} = 62.5, \quad \frac{F_{ST}}{F_L} = .30 \quad (\text{AN. 5, FIG. 5.42})$$

$$F_{ST} = 30 \times 7400 = 22,200 \text{ PSI}$$

THEN,

$$R_s = \frac{F_s}{F_{ST}} = \frac{16250}{22200} = .733$$

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LEADING EDGE (CONT'D.)NO. 1 SHEAR @ STA 17: (CONT'D.)

COMPRESSION DE T DIAGONAL TAIL 11

$$D = 4.5 \text{ in. chord} \quad \left\{ \begin{array}{l} \text{Use } D = 5 \text{ in. for } R_{c1} \\ 6.0 \text{ in. for } R_{c2} \end{array} \right.$$

$$F_{c1} = 4.84 \text{ in.} \cdot \frac{(1.04)^2}{(5)^2} = 1.4 \text{ lbs/in.}$$

$$F_{c2} = 6.50 - 1.24 = 5.26 \text{ lbs/in.}$$

$$P_{c1} = 2 F_{c1} \tan \alpha \cdot \frac{b}{2} = 2 \times 5.26 \times 1.13 \times \frac{5}{2} = 4550 \text{ lbs.}$$

Allow Compression: $(51145 + P_{c1} 25 + 26)$

ITEM	AREA	b/e or R/e	F _{c1}	P _{c1}
1	.195	(P _{c1} 25)	37400	7300
2	.128	(P _{c1} 26)	41000	5250
3	.160	50	19000	3040
4	.047	13	65000	3060
Σ	.530		35200	18650

THEN,

$$R_c = \frac{4550}{18650} = .244$$

AND THE INTERACTION MARGIN OF SAFETY

$$M.S. = \frac{1}{\sqrt{(1.733)^2 + (.244)^2}} - 1 = +.29 M.$$

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LEADING EDGE (CONTD)UPPER SURFACE STIFFNESSSTA 10) PANEL "A" + 3 1/2" GUSSET CORNERS

$$P_c = 4931 \text{ LB} \quad (\text{Pg. 45})$$

$$Q = 650 \text{ LB/IN.} \quad (\text{Pg. 57})$$

$$\left. \begin{aligned} \text{STRA. AREA, } A_s &= .143 \text{ in.}^2 \\ \text{STRA. } I_c &= .017 \text{ in.}^4 \\ P_c &= .364 \text{ in.} \end{aligned} \right\} (\text{Pg. 265})$$

$$\text{RIB SPACING} = 10 \text{ IN.} \quad (\text{Pg. 22})$$

$$\text{END FIXITY, } C = 1.5$$

$$1/P_c = \frac{10}{.364 \sqrt{1.5}} = 22.4$$

$$F_{c0} = 72000 \text{ PSI} \quad \text{71500 EXTN.} \quad (\text{SM 83})$$

$$\text{SKIN, } t = .040 \text{ IN.}$$

$$F_{su} = F_{su} = 44000 \text{ PSI}$$

$$f_c = \frac{4931}{.143} = 34500 \text{ PSI}$$

$$R_{c1} = \frac{34500}{72000} = .48$$

$$f_s = \frac{650}{.040} = 16250 \text{ PSI}$$

$$R_s = \frac{16250}{44000} = .37$$

$$M.S. = \frac{1}{\sqrt{(.48)^2 + (.37)^2}} - 1 =$$

+ .65 M.S.

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LEADING EDGE (CONT'D)UPPER SURFACE - LOCAL INTERACTION

STA 180 FLEWER "C1" +30 ft. (best correlation)

$$P_c = 4751 \text{ LBS.} \quad (\text{Pg. 48})$$

$$Q = 650 \text{ LBS./IN.} \quad (\text{Pg. 57})$$

$$P_{ALL} = 2.0 \text{ PSI} \quad (\text{Pg. 67})$$

$$P_{CROSS} \sim \text{NEGLECTABLE}$$

$$P_{FOEL} = 12.2 \text{ PSI} \quad (\text{Pg. 63})$$

$$A_{STUCK} = .143 \text{ IN.}^2$$

$$I_{STUCK} = .019 \text{ IN.}^4$$

$$\bar{Y}_{SKIN} = .258 \text{ IN.}$$

$$\bar{Y}_{CAP} = .682 \text{ IN.}$$

$$t_{SKIN} = .040 \text{ IN.}$$

$$RIB \text{ SPACING} = 10 \text{ IN.}$$

(Pg. 26)

(Pg. 22)

$$f_c = \frac{4931}{.143} = 34500 \text{ PSI}$$

$$j = \sqrt{\frac{107(.019)}{4931}} = 6.2$$

$$4/j = 10/6.2 = 1.61$$

$$CMM = 22.2$$

(Pg. 69)

$$W = 4(2 + 12) = 57 \text{ LBS./IN.}$$

$$M = \frac{57(10)^2}{22.2} = 257 \text{ IN. LBS.}$$

$$f_{0'CAP} = \frac{257 \times .692}{.019} = 9200 \text{ PSI}$$

$$f_c + f_{0'} = 34500 + 9200 = 43700 \text{ PSI}$$

$$F_{0'CAP} = 51000 \text{ PSI}$$

(Pg. 26)

$$M.S._{CAP} = \frac{51000}{43700} - 1 =$$

+ .16 M.

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LEADING EDGE (CONTD)

SPANNING STRIKE

STD. 170 ATTACK. AT 15° (CONTD)

$$q = 650 \text{ LBS./IN.} \quad (\text{Pg. 57})$$

$$F_{scr} = R_s K_s E \left(\frac{t}{b}\right)^2$$

$$R_s = .25 \quad \text{EFFECT OF PRINCIPAL COMPRESSION}$$

$$K_s = 9.8 \quad (\text{SM 33, FIG. 5})$$

$$E = 10^7 \text{ PSI}$$

$$t = .040$$

$$b = 4.0 \quad b/c = 130 \quad b/a = .4$$

$$F_{scr} = .25 \times 9.8 \times 10^7 \left(\frac{.040}{4}\right)^2 = 2450 \text{ PSI}$$

$$q_{scr} = 2450 \times .040 = 100 \text{ LBS./IN.}$$

$$q_{at} = 650 - 100 = 550 \text{ LBS./IN.}$$

$$q_R = 650 \rightarrow 550 = 850 \text{ LBS./IN.}$$

ATTACH. BY DDG RIVETS @ 75 IN. SPACING
FLUSH IN .040 75576 ALLAD SKIN. (DNG. W-2)

$$q_{allow} = \frac{650}{.75} = 866 \text{ LBS./IN.}$$

$$M.S. \text{ ATTACH.} = \frac{866}{550} - 1 = +.024$$

$$n = 1 - \frac{.01225}{.040 \times .75} = .59$$

$$R_s = \frac{650}{.59 \times 44000 \times .040} = .63$$

$$R_t = \frac{550}{.59 \times 74000 \times .040} = .25$$

$$M.S. \text{ NET RIVETS} = \frac{1}{\sqrt{1 + .59^2}} - 1 = +.474$$

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48% BEAM

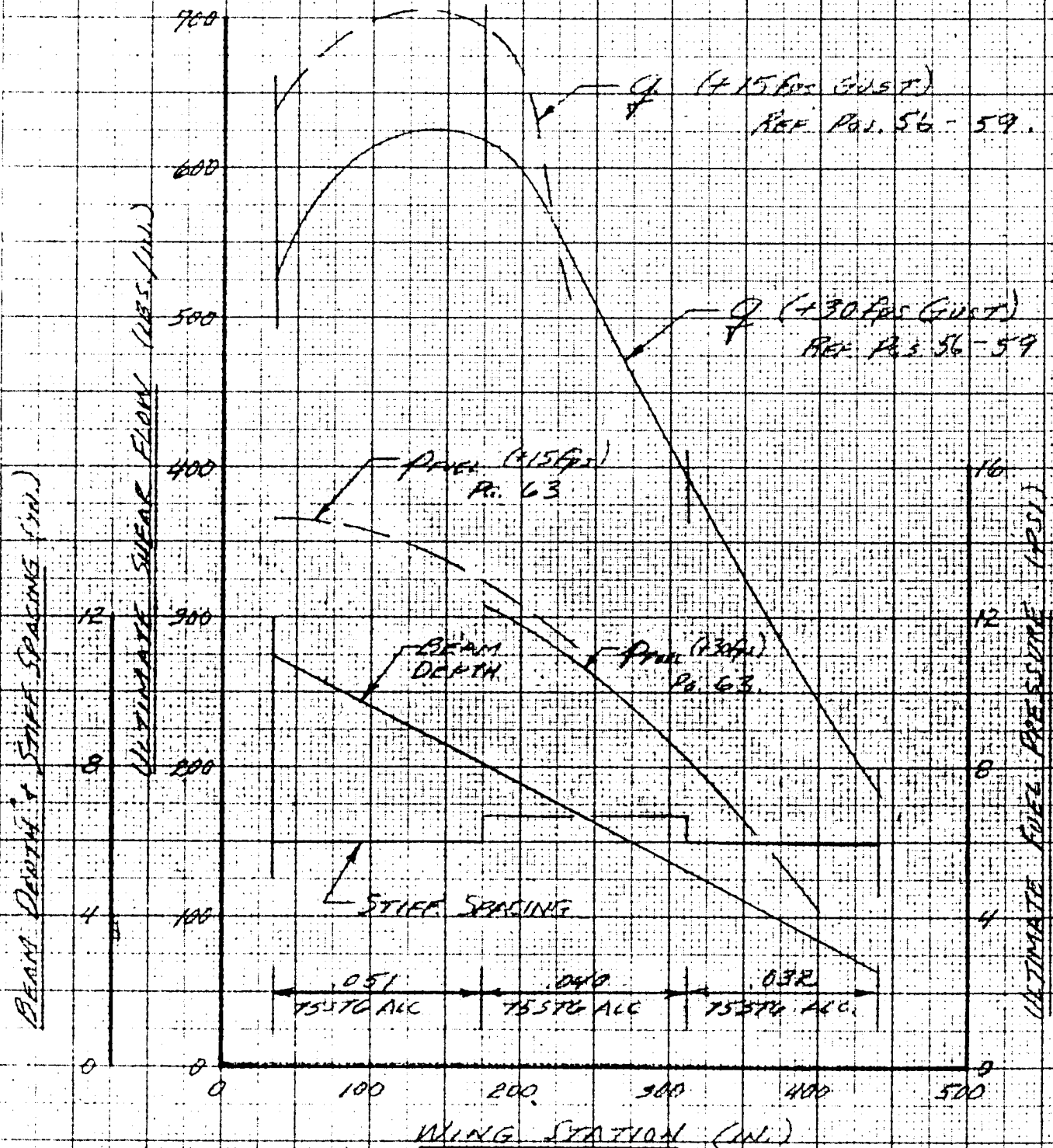
(REF. Dwg. W-3)

DISCUSSION

THE INTERMEDIATE SHEAR BEAM IS LOCATED AT 48% OF THE WING CHORD AND SERVES TO SEPARATE THE FORWARD MAIN FUEL TANK FROM THE AFT AUXILIARY TANK. CONSTRUCTION IS OF THE CONVENTIONAL PARTIAL TENSION FIELD TYPE OF 755T6 ALCLAD WEB AND 245T81 EXTRUDED STIFFENERS.

CRITICAL SHEAR FLOWS AND FUEL PRESSURES ARE SHOWN ON THE FOLLOWING PAGE ALONG WITH WEB GAGES, STIFFENER SPACING ETC.

48 TO BEAM
ULTIMATE SHEAR FLOW
AND
STRUCTURAL DATA
(SEE DWG. W 3)



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48% BEAM (CONT'D.)

STA 36 → 175 .05175376 ALL WBS
LS 2174 245781 EYIN STIFF

$f_{max} = 705 \text{ LBS./IN.}$

CRITICAL CONDITION ~ 115 FPS GUST

WEB ANALYSIS (REF. DNG. W-3)

$$f_{CR} = 4.84 \times 10^7 \frac{(0.051)^3}{(6)^2} = 180 \text{ LBS./IN.}$$

$$f_{D.T.} = 705 - 180 = 525 \text{ LBS./IN.}$$

ATTACH. TO CAP ARE DDG RIVETS @ .75 IN.

$$n = 1 - \frac{.19}{.75} = .75$$

$$R_s = \frac{705}{.051 \times 44000 \times .75} = .42$$

$$R_T = \frac{525}{.051 \times 74000 \times .75} = .19$$

$$M.S. = \sqrt{(0.42)^2 + (0.19)^2} - 1 =$$

+ LAGIE N.

WEB TO CAP ATTACHMENTS (REF. DNG. W-3)

$$f_R = 705 \rightarrow 525 = 880 \text{ LBS./IN.}$$

ATTACH. TO CAP ARE DDG RIVETS @ .75 IN.

$$f_{ALLOW} = \frac{1147}{.75} = 1530 \text{ LBS./IN. (SM 73)}$$

$$M.S. = \frac{1530}{880} - 1 =$$

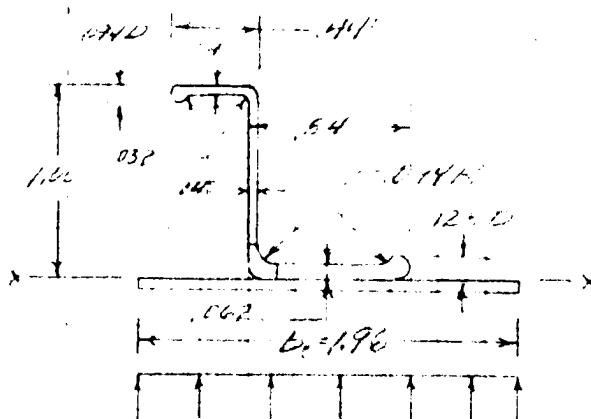
+ .74 MS

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48% BENT (cont'd)

STA 36 → 175 (cont'd)

STIFFENER 253174 245781 EXTR.

FUEL PRESSURE
 $P = 14.6 \text{ PSI}$

FLANGE CLIPPING 24945

ITEM	AREA	$\bar{y}$	$A\bar{y}$	$A\bar{y}^2$	I_0
FLANGE	.014	2.4	.034	.082	.950
WEB	.042	11.4	.479	5.46	.159
Σ	.066		.513	.548	1.109

$$D = 2.52 \times 15.3 \times .257 = 1.96 \text{ in.}$$

$$A_{WEB} = 1.96 \times .021 = .041 \text{ in.}^2$$

SECTION PROPERTIES:

ITEM	AREA	$\bar{y}$	$A\bar{y}$	$A\bar{y}^2$	I_0
STIFF.	.115	.314	.036	.011	.0170
WEB	.100	-.025	-.0025	.0001	-
Σ	.215	.179	.0335	.0111	.0170

$$I_{NA} = .0316 - .179(.0335) = .0247 \text{ in.}^2$$

$$r = \sqrt{\frac{.0247}{.215}} = .339, L = 10 \text{ in.}$$

$$\frac{L}{r} = \frac{10}{.339} = 29.5, F_{cr} = 47.5 \text{ PSI (SEE BS)}$$

LOAD DUE TO SHEAR:

$$F_s = 2.90 \times 1.525 = 3150 \text{ BS.}$$

$$F_s = \frac{2.90}{3.14} = 147 \text{ PSI}$$

$$M_s = 31 \times (.179 \times .314) = 3.45 \text{ in. LBS.}$$

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48 1/2 BEAM (CONT'D.)

STA. 36-175 (CONT'D.)

STIFFENER (CONT'D.)

LOADS DUE TO FREQUENCIES:

$$W = 6 \times 14.6 = 87.6 \text{ LBS./IN.}$$

$$M_D = \frac{87.6 (175)^2}{8} = 1095 \text{ IN. LBS.}$$

COMBINED LOADS:

$$M' = (645 + 1095) \left(\frac{1}{1 - \frac{14700}{47500}} \right) = 2520 \text{ IN. LBS.}$$

AMPLIFICATION REF. NILES INMAN, VOL. II.

$$f_c = 14700 + \frac{2520 (179 - 0.31)}{0.0247} = 30000 \text{ PSI}$$

$$F_{cc} = 41200 \text{ PSI. (Pg. 97)}$$

$$M.S. = \frac{41200}{30000} - 1 = +.37$$

STIFFENER TO CAP ATTACHMENT

$$P_c = 3150 \text{ LBS.}$$

USING 2 EFFECTIVE WIDTHS OF WEB (6 DISSETTING)
ATTACH. BY 3/16 LOCKBOLT THRU STIFFENER
AND 4 DUB RIPPED THRU WEB. (REF. DWG. W-3)

$$P_{allow} = 4 \times 1147 = 4590 \text{ LBS. (LOCKBOLT LIMITS)}$$

$$M.S. = \frac{4590}{3150} - 1 = +.45$$

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4870 BEAM (CONT'D.)

STA 175 → 312 .040 75 ST6 ALL. WEB
LS 2174 24 ST81 EXTR. STIFF.

$$\left. \begin{aligned} q_{MAX} &= 690 \text{ LBS./IN.} \\ \text{CRITICAL CONN} &\sim +15 \text{ PSI (JUST)} \end{aligned} \right\} \text{ (PG. 57)}$$

WEB ANALYSIS (REF DWG. W-3)

$$q_{OR} = 4.84 \times 10^7 \frac{(.040)^3}{(6)^2} = 86 \text{ LBS./IN.}$$

$$q_{DT} = 690 - 86 = 604 \text{ LBS./IN.}$$

ATTACH. TO CAP ARE DD6 RIVETS @ .75 IN.

$$n = 1 - \frac{.19}{.75} = .75$$

$$R_S = \frac{690}{.040 \times 44000 \times .75} = .52$$

$$R_T = \frac{604}{.040 \times 74000 \times .75} = .27$$

$$M.S. = \sqrt{(1.52)^2 + (.27)^2} - 1 = +.70 M.$$

WEB TO CAP ATTACHMENTS (REF DWG. W-3)

$$q_R = 690 \rightarrow 604 = 920 \text{ LBS./IN.}$$

ATTACH. ARE DD6 RIVETS @ .75 IN.

$$q_{allow} = \frac{1075}{.75} = 1435 \text{ LBS./IN. (SM TB)}$$

$$M.S. = \frac{1435}{920} - 1 = +.56 M.$$

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48% BEAM (CONT'D)

STA. 175 → 312 (CONT'D)

STIFFENER LS 2174 245751 ENT. R.

SEE SKETCH, PAGE 97.

FOURMOM = 41700 PSI

$$b_c = 2.52 \times 15.3 \times .040 = 1.5 \text{ in.}$$

$$A_{WEB} = 1.5 \times .040 = .060 \text{ in.}^2$$

SECTION PROPERTIES:

ITEM	AREA	Y	AY	AY ²	I ₀
STIFF	.115	.314	.0409	.0145	.070
WEB	.060	-.020	-.0012	-	-
Σ	.175	.226	.0397	.0145	.0170

$$I_{NA} = .0316 - .226(.0397) = .0226 \text{ in.}^4$$

$$p = \sqrt{\frac{.0226}{.175}} = .359 \text{ in.}, L = 7 \text{ in.}$$

$$4/p = \frac{7}{.359} = 19.5, F_{0.5} = 50000 \text{ PSI (SM 83)}$$

LOAD DUE TO SHEAR:

$$P_c = b_{fUT} \times b \times 604 = 3624 \text{ LBS}$$

$$f_c = \frac{3624}{.175} = 20700 \text{ PSI}$$

$$M_c = 3624 \left(.226 + \frac{.240}{2} \right) = 890 \text{ in. LBS.}$$

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48% BEAM (CONT'D)

STIFFENERS → 312 (CONT'D)

STIFFENER (CONT'D)

LOADS DUE TO PRESSURE:

$$P = 13 \text{ PSI} \quad (Pg. 95)$$

$$W = 6 \times 13 = 78 \text{ LBS./IN.}$$

$$M_p = \frac{78(7)^2}{8} = 478 \text{ IN. LBS.}$$

COMBINED LOADS:

$$M' = (890 + 478) \left(\frac{1}{1 - \frac{20700}{50000}} \right) = 2320 \text{ IN. LBS.}$$

AMPLIFICATION REF. AISC & NEWELL, VOL. II.

$$f_c = 20700 + \frac{2320 \times 1.794}{.0226} = 40600 \text{ PSI}$$

$$F_{c \text{ STIFFEN}} = 41200 \text{ PSI}$$

$$M.S. = \frac{41200}{40600} - 1 = +.01 M.$$

STIFFENER TO CAP ATTACHMENT

$$P_c = 3624 \text{ LBS.}$$

USING 2 EFFECTIVE WIDTHS OF WEB = $2 \times 1.5 = 3 \text{ IN.}$
ATTACHMENT IS MADE BY 4 DRG LINES
AND ONE $3/16$ LOCKBOLT. (REF. DIM. W-3)

$$P_{c \text{ DRG}} = 4 \times 1075 = 4300 \text{ LBS. (LOCKBOLT OMITTED)}$$

$$M.S. = \frac{4300}{3624} - 1 = +.18 M.$$

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4870 BEAM (CONT'D)

STA. 312 → 440 .032 75ST6 ALL. WEB
LS3578 245781 EXTR. STIFFENER

$q_{max} = 390 \text{ LBS./IN.}$
CRITICAL CONDITION ~ +30 PSI GUST } (Pg. 58)

WEB ANALYSIS (REF. DWG. N:3)

$d < b$, $d = 5 \text{ IN.}$

$$q_{CR} = 4.84 \times 10^7 \frac{(.032)^3}{(5)^2} = 63 \text{ LBS./IN.}$$

$$q_{DT} = 390 - 63 = 327 \text{ LBS./IN.}$$

ATTACH. TO CAP ARE ADV RIVETS @ .75

$$n = 1 - \frac{.16}{.75} = .79$$

$$R_s = \frac{390}{.032 \times 44000 \times .79} = .35$$

$$R_T = \frac{327}{.032 \times 73000 \times .79} = .18$$

$$M.S. = \frac{1}{\sqrt{(.35)^2 + (.18)^2}} - 1 = \text{+ LARGE M.}$$

WEB TO CAP ATTACHMENT

$$q_L = 390 \rightarrow 327 = 510 \text{ LBS./IN.}$$

$$q_{ALLOW} = \frac{547}{.75} = 730 \text{ LBS./IN. (SM 73)}$$

$$M.S. = \frac{730}{510} - 1 = \text{+ .43 MS}$$

STIFFENER

NOT CRITICAL

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65% BEAM

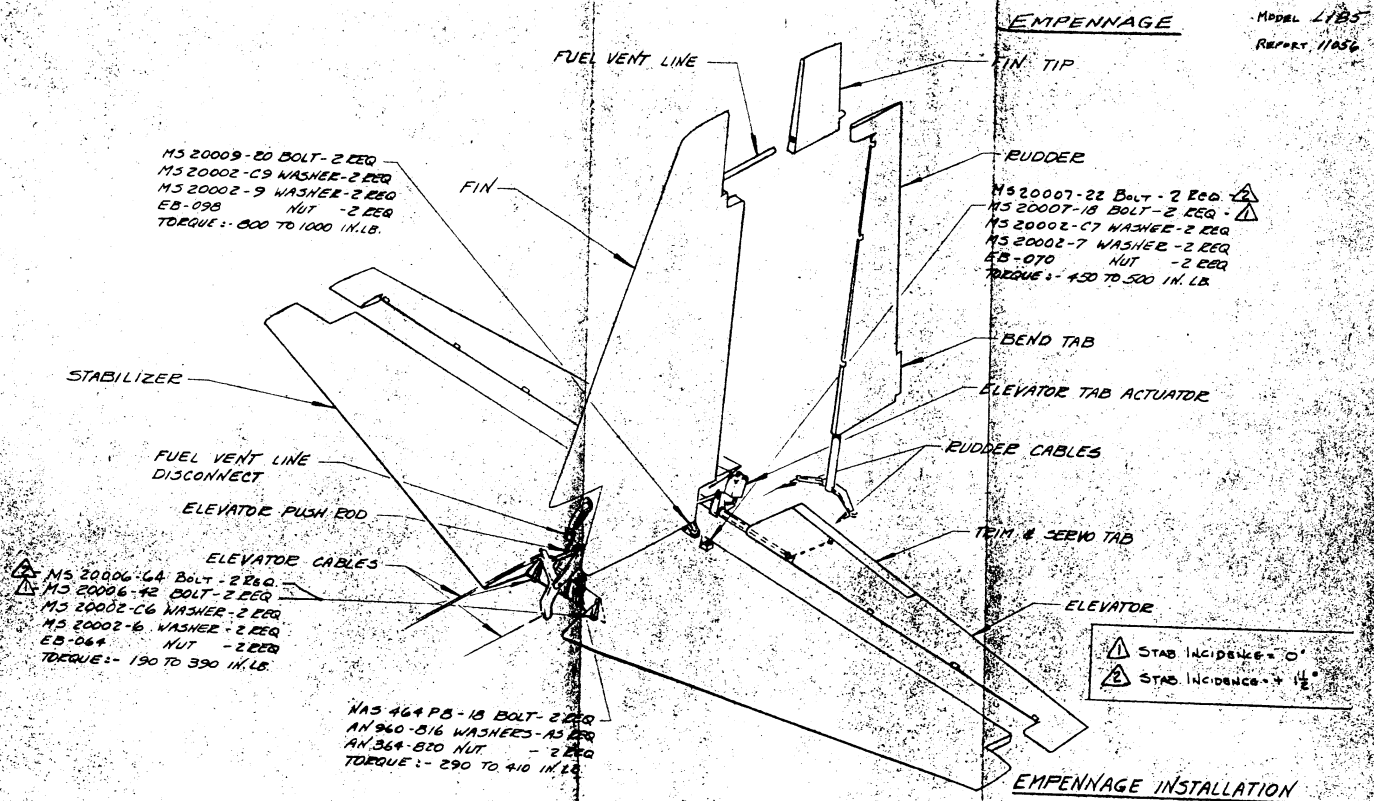
(REF. DNG. W-4)

DISCUSSION

THE REAR SHEAR BEAM IS LOCATED AT THE 65% WING CHORD LINE AND FORMS THE AFT WALL OF THE AUXILIARY FUEL TANK FROM WING STATION 36 TO 300. CONSTRUCTION IS OF THE CONVENTIONAL PARTIAL TENSION FIELD TYPE OF 15ST6 ALLAD WEB AND 24ST81 EXTRUDED STIFFENERS.

CRITICAL CONDITIONS ARE +15FPS GUST AT V_D FOR INBOARD PORTIONS AND THE POSITIVE ROLL MANEUVER OUTBOARD. BY INSPECTION OF THE SHEAR FLOWS GIVEN IN TAB 3 FORMS ON PAGES 56 THRU 59 (WEB 18), IT IS NOTED THAT LOADS ARE LESS THAN THOSE ON THE 48% BEAM (WEB BC).

SINCE LOADS ARE LOWER AND SINCE WEB GAGES AND STIFFENERS ARE IDENTICAL TO THOSE ON THE 48% BEAM, IT IS OBVIOUS THAT THE 65% BEAM IS NOT CRITICAL BY COMPARISON.



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THE STABILIZER GEOMETRY IS SHOWN ON PG. 106. THE STABILIZER IS OF CONVENTIONAL GEOMETRY AND CONSTRUCTION HAVING A FRONT SPAR AT 23.329% CHORD LINE, AN ELEVATOR HINGE LINE AT 75% CHORD LINE, AND A REAR SPAR THREE INCHES FORWARD OF AND PARALLEL TO THE 75% CHORD LINE. OTHER BENDING STRUCTURE INCLUDES A SERIES OF SPANWISE HAT SECTION STRINGERS, SPACED AT 3.5 INCHES AND SPOTWELDED TO THE SKIN. THERE IS ALSO A SINGLE HAT SECTION STRINGER ON EACH SURFACE OF THE LEADING EDGE ALONG THE 12% CHORD LINE. THE AIRFOIL SECTION IS SYMMETRICAL BOTH GEOMETRICALLY AND STRUCTURALLY. THE SURFACE SUPPORT STRUCTURE CONSISTS OF CHORDWISE RIBS SPACED AT APPROXIMATELY TEN INCH INTERVALS WITH INTERMEDIATE RIBS BETWEEN THESE IN THE LEADING EDGE TO STAB. STA. 96. IN ADDITION, THERE IS AN AUXILIARY RIB CANTED BETWEEN THE FRONT AND REAR SPAR FUSELAGE ATTACH POINTS TO REDISTRIBUTE FRONT SPAR SWEEP KICK LOADS. THE TWO HALVES OF THE STABILIZER SPARS ARE SPLICED BY MEANS OF MACHINED FITTINGS WHICH ALSO SERVE TO PROVIDE FIN AND FUSELAGE ATTACH POINTS.

DESIGN LOAD

THE DESIGN LOAD IS SELECTED TO COVER THE ENVELOPE SHOWN IN LR 11055, PG. 6.75. MAX. WEIGHT IS 4000 LBS. LIMIT. TO ALLOW FOR UNSYMMETRICAL DISTRIBUTION A FACTOR OF 1/2 IS APPLIED AND TO ALLOW FOR DYNAMIC EFFECTS AN ADDITIONAL FACTOR OF 1.25 IS USED.

$$P_{BT} \text{ (ULTIMATE)} = 4000 \times 1/2 \times 1.25 = 2500 \text{ LBS.}$$

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STABILIZER GEOMETRY

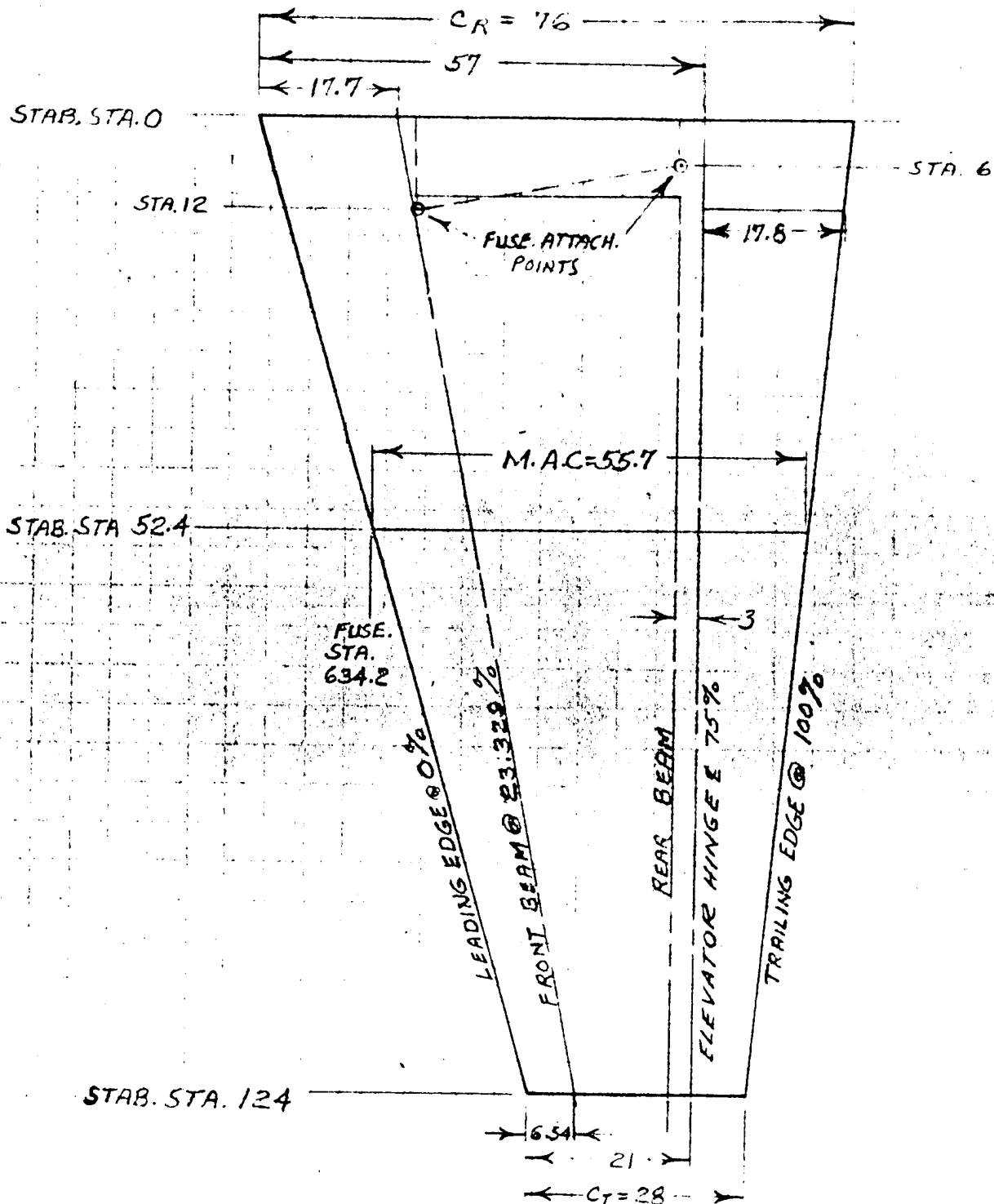
TR = 2.74

63A007 AIRFOIL

S = 90 SQ. FT.

AR = 4.75

REF. DWG. E-19

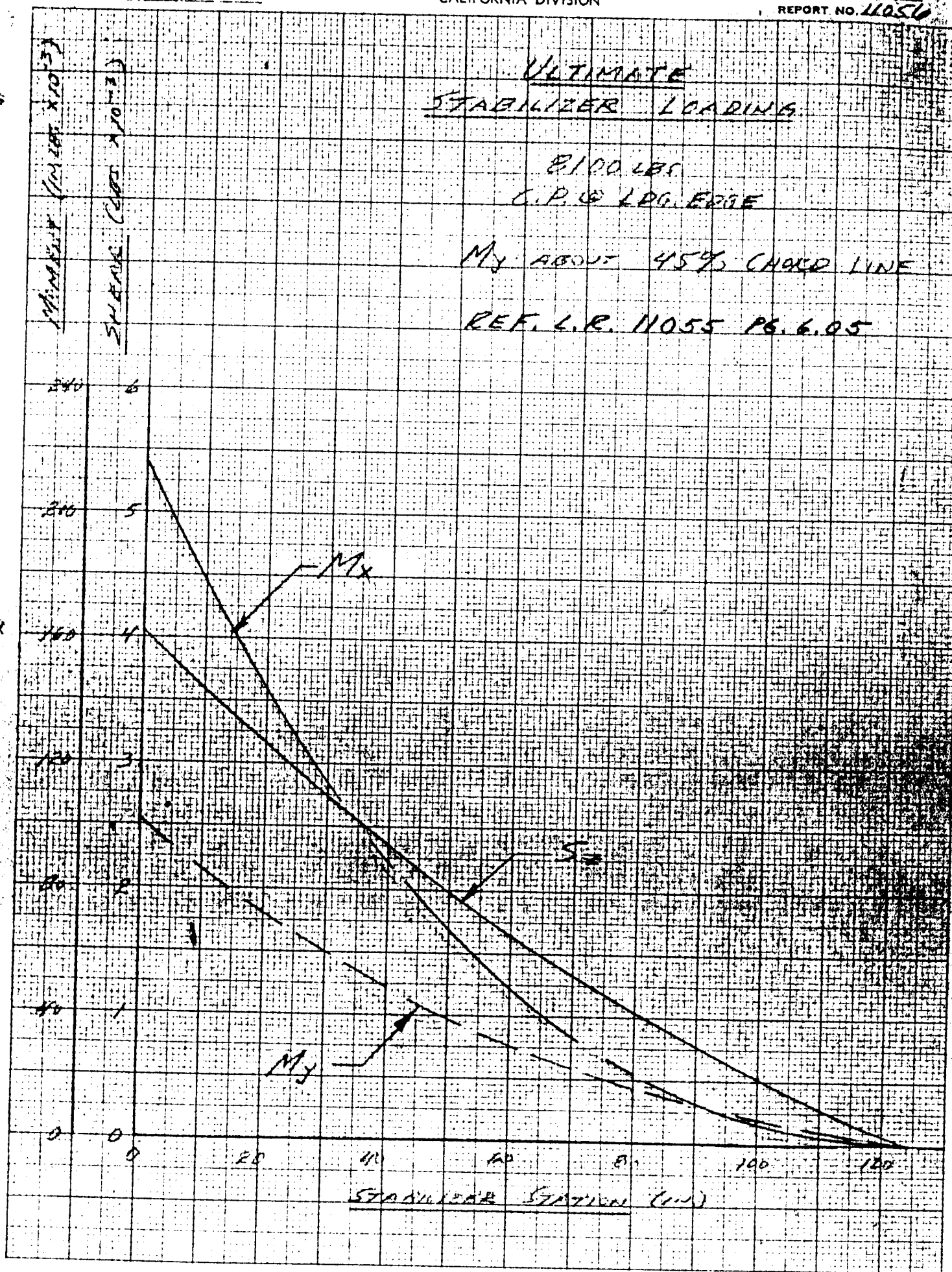


ULTIMATE STABILIZER LOADING

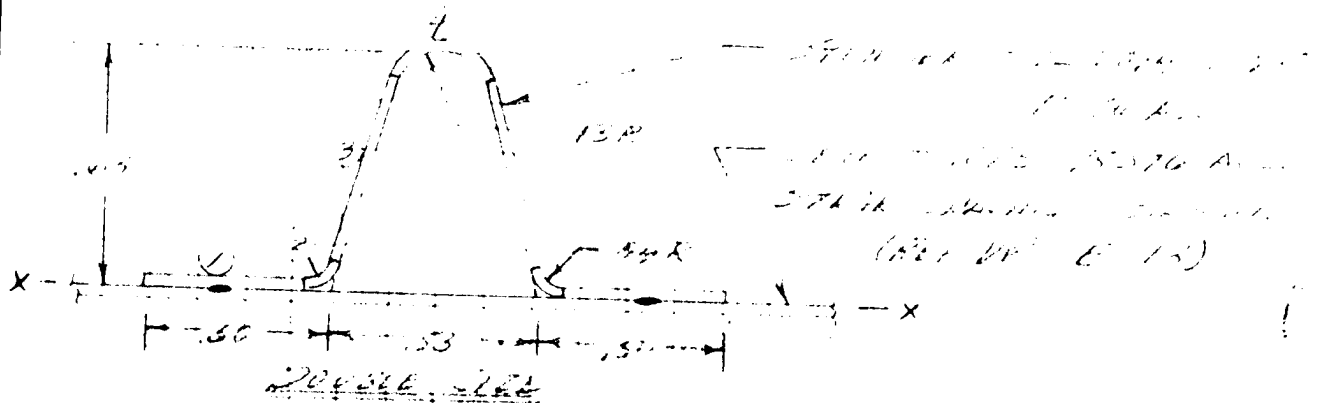
8100 LBS
C.P. @ L.D. EDGE

M_y ABOUT 45% CHORD LINE

REF. L.R. 11055 PG. 6.05



Prepared		DATE 28-55	LOCKHEED AIRCRAFT CORP. CALIFORNIA DIVISION	Page	108
Checked			TITLE <u>STABILIZER</u>	Model	L185
Approved				Report No.	11056

SECTION PROPERTIESUPPER + LOWER SURFACE - TYPICAL FINISH 1917

11	AREA	D/E IN $R_{1/2}$	Force	Per
1	.02156	17.2	14200	304
2	.00412	2.9	73600	344
3	.02450	19.6	46000	1128
4	.00866	5.4	72000	624
Σ	.05938			2400

$$F_{cc} = \frac{2400}{.05938} = 40400 \text{ PSI} \quad (\text{SM45})$$

$$b_c = 15 \times .025 \times 2.42 = .90 \text{ IN.} \quad (\text{SM23})$$

$$A_{skid} = 2 \times .90 \times .125 = .225 \text{ IN.}^2$$

11	AREA	Y	AY	AY ²	I ₀
1	.0215	.0125	.00027	.00003	—
2	.0047	.0300	.00014	.00004	—
3	.0245	.3100	.00760	.23236	.0013
4	.0087	.4300	.00372	.15835	—
5	.0451	.7100	.03202	.2281	—
Σ	.1047	.21	.03267	.42305	.0013

$$I_{xx} = .0013 + 12100 \times .0013 = .0052 \text{ IN.}^4$$

$$r = \sqrt{\frac{I_{xx}}{A}} = \sqrt{\frac{.0052}{.1047}} = .071 \text{ IN.} \quad (\text{SM23, E 11})$$

$$I_{yy} = .0013 + 12100 \times .0013 = .0052 \text{ IN.}^4$$

TABULAR FORM 1 - STAB. SECTION PROPERTIES AT STATION 10

COMPRESSION TENSION IN UPPER SURFACE

MODEL 2-105
DATE 2-8-55
PAGE 109
REP. 1056

PLANE OR WEB	REF. CODE	DISTANCE FROM		FIRST MOMENTS ABOUT C.G.		SECOND MOMENT OF AREA	RECTANGULAR OF ACTUAL AREA	TWO AREA BETWEEN CHORD & WEB	EFF. WEB MOD. UNITS
		HOR. REF. AXIS	VERT. REF. AXIS	HOR. X _C	VERT. Y _C				
1	105	2.22	-13.08	18.85	-4.32	2.29	1.0	1.0	1.0
2	104	2.26	-8.68	2.47	-9.0	2.6	2.0	2.0	2.0
3	103	2.29	-5.98	2.81	-1.56	2.6	2.0	2.0	2.0
4	102	2.27	-2.18	2.99	-2.3	2.6	2.0	2.0	2.0
5	101	2.23	+1.07	2.75	+1.1	2.5	2.0	2.0	2.0
6	100	2.05	+4.92	2.77	+0.4	2.5	2.0	2.0	2.0
7	99	2.02	+7.57	2.88	+1.2	2.3	2.0	2.0	2.0
8	98	1.81	+10.82	2.07	+1.3	2.2	2.0	2.0	2.0
9	97	1.66	+14.07	1.91	+0.6	2.0	2.0	2.0	2.0
10	96	1.58	+17.32	1.72	+0.0	1.9	2.0	2.0	2.0
11	95	1.30	+19.62	1.52	+1.2	1.8	2.0	2.0	2.0
12	94	1.30	-1.30	1.76	-1.1	1.1	1.0	1.0	1.0
13	93	1.48	-1.48	1.72	-1.2	1.2	1.0	1.0	1.0
14	92	1.68	-1.68	1.67	-1.0	1.0	1.0	1.0	1.0
15	91	1.85	-1.85	1.63	-1.5	1.2	1.0	1.0	1.0
16	90	2.00	-2.00	1.58	-1.0	1.2	1.0	1.0	1.0
17	89	2.15	-2.15	1.53	-1.2	1.2	1.0	1.0	1.0
18	88	2.23	-2.23	1.49	-1.5	1.2	1.0	1.0	1.0
19	87	2.27	-2.27	1.45	-1.5	1.2	1.0	1.0	1.0
20	86	2.29	-2.29	1.41	-1.7	1.2	1.0	1.0	1.0
21	85	2.26	-2.26	1.38	-1.8	1.2	1.0	1.0	1.0
22	84	2.02	-2.02	1.34	-1.8	1.2	1.0	1.0	1.0
23	83	1.81	-1.81	1.31	-1.9	1.2	1.0	1.0	1.0
24	82	1.66	-1.66	1.28	-2.0	1.2	1.0	1.0	1.0
25	81	1.58	-1.58	1.25	-2.0	1.2	1.0	1.0	1.0
26	80	1.30	-1.30	1.22	-2.2	1.2	1.0	1.0	1.0
27	79	1.30	1.30	1.19	-2.2	1.2	1.0	1.0	1.0
28	78	1.48	1.48	1.16	-2.2	1.2	1.0	1.0	1.0
29	77	1.68	1.68	1.13	-2.2	1.2	1.0	1.0	1.0
30	76	1.85	1.85	1.10	-2.2	1.2	1.0	1.0	1.0
31	75	2.00	2.00	1.07	-2.2	1.2	1.0	1.0	1.0
32	74	2.15	2.15	1.04	-2.2	1.2	1.0	1.0	1.0
33	73	2.23	2.23	1.01	-2.2	1.2	1.0	1.0	1.0
34	72	2.27	2.27	0.98	-2.2	1.2	1.0	1.0	1.0
35	71	2.29	2.29	0.95	-2.2	1.2	1.0	1.0	1.0
36	70	2.26	2.26	0.92	-2.2	1.2	1.0	1.0	1.0
37	69	2.02	2.02	0.89	-2.2	1.2	1.0	1.0	1.0
38	68	1.81	1.81	0.86	-2.2	1.2	1.0	1.0	1.0
39	67	1.66	1.66	0.83	-2.2	1.2	1.0	1.0	1.0
40	66	1.58	1.58	0.80	-2.2	1.2	1.0	1.0	1.0
41	65	1.30	1.30	0.77	-2.2	1.2	1.0	1.0	1.0
42	64	1.30	-1.30	0.74	-2.2	1.2	1.0	1.0	1.0
43	63	1.48	-1.48	0.71	-2.2	1.2	1.0	1.0	1.0
44	62	1.68	-1.68	0.68	-2.2	1.2	1.0	1.0	1.0
45	61	1.85	-1.85	0.65	-2.2	1.2	1.0	1.0	1.0
46	60	2.00	-2.00	0.62	-2.2	1.2	1.0	1.0	1.0
47	59	2.15	-2.15	0.59	-2.2	1.2	1.0	1.0	1.0
48	58	2.23	-2.23	0.56	-2.2	1.2	1.0	1.0	1.0
49	57	2.27	-2.27	0.53	-2.2	1.2	1.0	1.0	1.0
50	56	2.29	-2.29	0.50	-2.2	1.2	1.0	1.0	1.0
51	55	2.26	-2.26	0.47	-2.2	1.2	1.0	1.0	1.0
52	54	2.02	-2.02	0.44	-2.2	1.2	1.0	1.0	1.0
53	53	1.81	-1.81	0.41	-2.2	1.2	1.0	1.0	1.0
54	52	1.66	-1.66	0.38	-2.2	1.2	1.0	1.0	1.0
55	51	1.58	-1.58	0.35	-2.2	1.2	1.0	1.0	1.0
56	50	1.30	-1.30	0.32	-2.2	1.2	1.0	1.0	1.0
57	49	1.30	1.30	0.29	-2.2	1.2	1.0	1.0	1.0
58	48	1.48	1.48	0.26	-2.2	1.2	1.0	1.0	1.0
59	47	1.68	1.68	0.23	-2.2	1.2	1.0	1.0	1.0
60	46	1.85	1.85	0.20	-2.2	1.2	1.0	1.0	1.0
61	45	2.00	2.00	0.17	-2.2	1.2	1.0	1.0	1.0
62	44	2.15	2.15	0.14	-2.2	1.2	1.0	1.0	1.0
63	43	2.23	2.23	0.11	-2.2	1.2	1.0	1.0	1.0
64	42	2.27	2.27	0.08	-2.2	1.2	1.0	1.0	1.0
65	41	2.29	2.29	0.05	-2.2	1.2	1.0	1.0	1.0
66	40	2.26	2.26	0.02	-2.2	1.2	1.0	1.0	1.0
67	39	2.02	2.02	0.00	-2.2	1.2	1.0	1.0	1.0
68	38	1.81	1.81	0.00	-2.2	1.2	1.0	1.0	1.0
69	37	1.66	1.66	0.00	-2.2	1.2	1.0	1.0	1.0
70	36	1.58	1.58	0.00	-2.2	1.2	1.0	1.0	1.0
71	35	1.30	1.30	0.00	-2.2	1.2	1.0	1.0	1.0
72	34	1.30	-1.30	0.00	-2.2	1.2	1.0	1.0	1.0
73	33	1.48	-1.48	0.00	-2.2	1.2	1.0	1.0	1.0
74	32	1.68	-1.68	0.00	-2.2	1.2	1.0	1.0	1.0
75	31	1.85	-1.85	0.00	-2.2	1.2	1.0	1.0	1.0
76	30	2.00	-2.00	0.00	-2.2	1.2	1.0	1.0	1.0
77	29	2.15	-2.15	0.00	-2.2	1.2	1.0	1.0	1.0
78	28	2.23	-2.23	0.00	-2.2	1.2	1.0	1.0	1.0
79	27	2.27	-2.27	0.00	-2.2	1.2	1.0	1.0	1.0
80	26	2.29	-2.29	0.00	-2.2	1.2	1.0	1.0	1.0
81	25	2.26	-2.26	0.00	-2.2	1.2	1.0	1.0	1.0
82	24	2.02	-2.02	0.00	-2.2	1.2	1.0	1.0	1.0
83	23	1.81	-1.81	0.00	-2.2	1.2	1.0	1.0	1.0
84	22	1.66	-1.66	0.00	-2.2	1.2	1.0	1.0	1.0
85	21	1.58	-1.58	0.00	-2.2	1.2	1.0	1.0	1.0
86	20	1.30	-1.30	0.00	-2.2	1.2	1.0	1.0	1.0
87	19	1.30	1.30	0.00	-2.2	1.2	1.0	1.0	1.0
88	18	1.48	1.48	0.00	-2.2	1.2	1.0	1.0	1.0
89	17	1.68	1.68	0.00	-2.2	1.2	1.0	1.0	1.0
90	16	1.85	1.85	0.00	-2.2	1.2	1.0	1.0	1.0
91	15	2.00	2.00	0.00	-2.2	1.2	1.0	1.0	1.0
92	14	2.15	2.15	0.00	-2.2	1.2	1.0	1.0	1.0
93	13	2.23	2.23	0.00	-2.2	1.2	1.0	1.0	1.0
94	12	2.27	2.27	0.00	-2.2	1.2	1.0	1.0	1.0
95	11	2.29	2.29	0.00	-2.2	1.2	1.0	1.0	1.0
96	10	2.26	2.26	0.00	-2.2	1.2	1.0	1.0	1.0
97	9	2.02	2.02	0.00	-2.2	1.2	1.0	1.0	1.0
98	8	1.81	1.81	0.00	-2.2	1.2	1.0	1.0	1.0
99	7	1.66	1.66	0.00	-2.2	1.2	1.0	1.0	1.0
100	6	1.58	1.58	0.00	-2.2	1.2	1.0	1.0	1.0
101	5	1.30	1.30	0.00	-2.2	1.2	1.0	1.0	1.0
102	4	1.30	-1.30	0.00	-2.2	1.2	1.0	1.0	1.0
103	3	1.48	-1.48	0.00	-2.2	1.2	1.0	1.0	1.0
104	2	1.68	-1.68	0.00	-2.2	1.2	1.0	1.0	1.0
105	1	1.85	-1.85	0.00	-2.2	1.2	1.0	1.0	1.0
106	0	2.00	-2.00	0.00	-2.2	1.2	1.0	1.0	1.0
107	-1	2.15	-2.15	0.00	-2.2	1.2	1.0	1.0	1.0
108	-2	2.23	-2.23	0.00	-2.2	1.2	1.0	1.0	1.0
109	-3	2.27	-2.27	0.00	-2.2	1.2	1.0	1.0	1.0
110	-4	2.29	-2.29	0.00	-2.2	1.2	1.0	1.0	1.0
111	-5	2.26	-2.26	0.00	-2.2	1.2	1.0	1.0	1.0
112	-6	2.02	-2.02	0.00	-2.2	1.2	1.0	1.0	1.0
113	-7	1.81	-1.81	0.00	-2.2	1.2	1.0	1.0	1.0
114	-8	1.66	-1.66	0.00	-2.2	1.2	1.0	1.0	1.0
115	-9	1.58	-1.58	0.00	-2.2	1.2	1.0	1.0	1.0
116	-10	1.30	-1.30	0.00	-2.2	1.2	1.0	1.0	1.0
117	-11	1.30	1.30	0.00	-2.2	1.2	1.0	1.0	1.0
118	-12	1.48	1.48	0.00	-2.2	1.2	1.0	1.0	1.0
119	-13	1.68	1.68	0.00	-2.2	1.2	1.0	1.0	1.0
120	-14	1.85	1.85	0.00	-2.2	1.2	1.0	1.0	1.0
121	-15	2.00	2.00	0.00	-2.2	1.2	1.0	1.0	1.0
122	-16	2.15	2.						

2, 9, 19, 20 & 21 ----- 3 PLACES
3 TO 8 INCL. 22 AND 23 ----- 2 PLACES
10 ----- 6 PLACES
11 & 12 ----- 0 PLACES

REVISED
1-27-42
1-20-42
3-24-42

REF CODE	FORM	STAB.	SECTION	PROFILES	AL	STATION
301	1					

COMPRESSION
TENSION

IN UPPER
SURFACE

MODEL 4432 PAGE 116
DATE 11/11/71 REP. 11050

[illegible]

(1)	(2)	(3)	(4)	(5)		(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)	(31)	(32)	(33)	(34)	(35)	(36)	(37)	(38)	(39)	(40)	(41)	(42)	(43)	(44)	(45)	(46)	(47)	(48)	(49)	(50)	(51)	(52)	(53)	(54)	(55)	(56)	(57)	(58)	(59)	(60)	(61)	(62)	(63)	(64)	(65)	(66)	(67)	(68)	(69)	(70)	(71)	(72)	(73)	(74)	(75)	(76)	(77)	(78)	(79)	(80)	(81)	(82)	(83)	(84)	(85)	(86)	(87)	(88)	(89)	(90)	(91)	(92)	(93)	(94)	(95)	(96)	(97)	(98)	(99)	(100)	(101)	(102)	(103)	(104)	(105)	(106)	(107)	(108)	(109)	(110)	(111)	(112)	(113)	(114)	(115)	(116)	(117)	(118)	(119)	(120)	(121)	(122)	(123)	(124)	(125)	(126)	(127)	(128)	(129)	(130)	(131)	(132)	(133)	(134)	(135)	(136)	(137)	(138)	(139)	(140)	(141)	(142)	(143)	(144)	(145)	(146)	(147)	(148)	(149)	(150)	(151)	(152)	(153)	(154)	(155)	(156)	(157)	(158)	(159)	(160)	(161)	(162)	(163)	(164)	(165)	(166)	(167)	(168)	(169)	(170)	(171)	(172)	(173)	(174)	(175)	(176)	(177)	(178)	(179)	(180)	(181)	(182)	(183)	(184)	(185)	(186)	(187)	(188)	(189)	(190)	(191)	(192)	(193)	(194)	(195)	(196)	(197)	(198)	(199)	(200)	(201)	(202)	(203)	(204)	(205)	(206)	(207)	(208)	(209)	(210)	(211)	(212)	(213)	(214)	(215)	(216)	(217)	(218)	(219)	(220)	(221)	(222)	(223)	(224)	(225)	(226)	(227)	(228)	(229)	(230)	(231)	(232)	(233)	(234)	(235)	(236)	(237)	(238)	(239)	(240)	(241)	(242)	(243)	(244)	(245)	(246)	(247)	(248)	(249)	(250)	(251)	(252)	(253)	(254)	(255)	(256)	(257)	(258)	(259)	(260)	(261)	(262)	(263)	(264)	(265)	(266)	(267)	(268)	(269)	(270)	(271)	(272)	(273)	(274)	(275)	(276)	(277)	(278)	(279)	(280)	(281)	(282)	(283)	(284)	(285)	(286)	(287)	(288)	(289)	(290)	(291)	(292)	(293)	(294)	(295)	(296)	(297)	(298)	(299)	(300)	(301)	(302)	(303)	(304)	(305)	(306)	(307)	(308)	(309)	(310)	(311)	(312)	(313)	(314)	(315)	(316)	(317)	(318)	(319)	(320)	(321)	(322)	(323)	(324)	(325)	(326)	(327)	(328)	(329)	(330)	(331)	(332)	(333)	(334)	(335)	(336)	(337)	(338)	(339)	(340)	(341)	(342)	(343)	(344)	(345)	(346)	(347)	(348)	(349)	(350)	(351)	(352)	(353)	(354)	(355)	(356)	(357)	(358)	(359)	(360)	(361)	(362)	(363)	(364)	(365)	(366)	(367)	(368)	(369)	(370)	(371)	(372)	(373)	(374)	(375)	(376)	(377)	(378)	(379)	(380)	(381)	(382)	(383)	(384)	(385)	(386)	(387)	(388)	(389)	(390)	(391)	(392)	(393)	(394)	(395)	(396)	(397)	(398)	(399)	(400)	(401)	(402)	(403)	(404)	(405)	(406)	(407)	(408)	(409)	(410)	(411)	(412)	(413)	(414)	(415)	(416)	(417)	(418)	(419)	(420)	(421)	(422)	(423)	(424)	(425)	(426)	(427)	(428)	(429)	(430)	(431)	(432)	(433)	(434)	(435)	(436)	(437)	(438)	(439)	(440)	(441)	(442)	(443)	(444)	(445)	(446)	(447)	(448)	(449)	(450)	(451)	(452)	(453)	(454)	(455)	(456)	(457)	(458)	(459)	(460)	(461)	(462)	(463)	(464)	(465)	(466)	(467)	(468)	(469)	(470)	(471)	(472)	(473)	(474)	(475)	(476)	(477)	(478)	(479)	(480)	(481)	(482)	(483)	(484)	(485)	(486)	(487)	(488)	(489)	(490)	(491)	(492)	(493)	(494)	(495)	(496)	(497)	(498)	(499)	(500)	(501)	(502)	(503)	(504)	(505)	(506)	(507)	(508)	(509)	(510)	(511)	(512)	(513)	(514)	(515)	(516)	(517)	(518)	(519)	(520)	(521)	(522)	(523)	(524)	(525)	(526)	(527)	(528)	(529)	(530)	(531)	(532)	(533)	(534)	(535)	(536)	(537)	(538)	(539)	(540)	(541)	(542)	(543)	(544)	(545)	(546)	(547)	(548)	(549)	(550)	(551)	(552)	(553)	(554)	(555)	(556)	(557)	(558)	(559)	(560)	(561)	(562)	(563)	(564)	(565)	(566)	(567)	(568)	(569)	(570)	(571)	(572)	(573)	(574)	(575)	(576)	(577)	(578)	(579)	(580)	(581)	(582)	(583)	(584)	(585)	(586)	(587)	(588)	(589)	(590)	(591)	(592)	(593)	(594)	(595)	(596)	(597)	(598)	(599)	(600)	(601)	(602)	(603)	(604)	(605)	(606)	(607)	(608)	(609)	(610)	(611)	(612)	(613)	(614)	(615)	(616)	(617)	(618)	(619)	(620)	(621)	(622)	(623)	(624)	(625)	(626)	(627)	(628)	(629)	(630)	(631)	(632)	(633)	(634)	(635)	(636)	(637)	(638)	(639)	(640)	(641)	(642)	(643)	(644)	(645)	(646)	(647)	(648)	(649)	(650)	(651)	(652)	(653)	(654)	(655)	(656)	(657)	(658)	(659)	(660)	(661)	(662)	(663)	(664)	(665)	(666)	(667)	(668)	(669)	(670)	(671)	(672)	(673)	(674)	(675)	(676)	(677)	(678)	(679)	(680)	(681)	(682)	(683)	(684)	(685)	(686)	(687)	(688)	(689)	(690)	(691)	(692)	(693)	(694)	(695)	(696)	(697)	(698)	(699)	(700)	(701)	(702)	(703)	(704)	(705)	(706)	(707)	(708)	(709)	(710)	(711)	(712)	(713)	(714)	(715)	(716)	(717)	(718)	(719)	(720)	(721)	(722)	(723)	(724)	(725)	(726)	(727)	(728)	(729)	(730)	(731)	(732)	(733)	(734)	(735)	(736)	(737)	(738)	(739)	(740)	(741)	(742)	(743)	(744)	(745)	(746)	(747)	(748)	(749)	(750)	(751)	(752)	(753)	(754)	(755)	(756)	(757)	(758)	(759)	(760)	(761)	(762)	(763)	(764)	(765)	(766)	(767)	(768)	(769)	(770)	(771)	(772)	(773)	(774)	(775)	(776)	(777)	(778)	(779)	(780)	(781)	(782)	(783)	(784)	(785)	(786)	(787)	(788)	(789)	(790)	(791)	(792)	(793)	(794)	(795)	(796)	(797)	(798)	(799)	(800)	(801)	(802)	(803)	(804)	(805)	(806)	(807)	(808)	(809)	(810)	(811)	(812)	(813)	(814)	(815)	(816)	(817)	(818)	(819)	(820)	(821)	(822)	(823)	(824)	(825)	(826)	(827)	(828)	(829)	(830)	(831)	(832)	(833)	(834)	(835)	(836)	(837)	(838)	(839)	(840)	(841)	(842)	(843)	(844)	(845)	(846)	(847)	(848)	(849)	(850)	(851)	(852)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ONE CELL

TWO CELL

(THIS ANALYSIS ASSUMES TEMPORARY CUTS [-]) AS SHOWN IN THE DIAGRAM.

THREE CELL

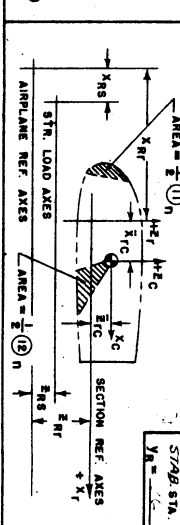
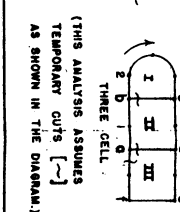
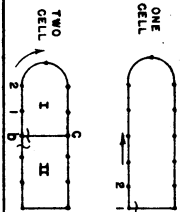
COMPUTATIONS

ROW	ITEM	REF. OR OPER.	DEC	VALUE	ROW
1	$E(Ax)$	$E(2)$	3	39.970	1
2	$E(A)$	$E(2)$	3	2.945	2
3	$E_o = E(Ax) + EA$	$1 + E$	2	13.57	3
4	$E(LAR)$	$E(2)$	3	1.655	4
5	$E_o(LAR) + EA$	$4 + E$	2	1.22	5
6	MOMENTS I_{NE}	$E(2)$	2	10.37	6
7	OF I_x	$E(2)$	2	10.37	7
8	INERTIA I_y	$E(2)$	2	10.37	8
9	$I_o = I_x + I_y$	$E(2)$	2	10.37	9
10	$I_o = I_x + I_y$	$E(2)$	2	10.37	10

ROW	ITEM	REF. OR OPER.	DEC	VALUE	ROW
11	$10^4 I_x + I_x I_y - I_y^2$	7	3	3007.251	11
12	$10^4 I_y + I_x I_y - I_x^2$	8	3	9683.720	12
13	LOCATION OF REF. AXES	X_{R1}	REF.	—	13
14	LOCATION OF REF. AXES	Y_{R1}	REF.	—	14
15	LOAD AXES	X_{R2}	REF.	—	15
16	LOAD AXES	Y_{R2}	REF.	—	16
17	C.G. RELATIVE TO LOAD AXES	X_{R3}	$3 + 10$	2	17
18	SIN θ	13	$14 - 10$	2	18
19	COS θ	11	11	—	19
20	SIN θ	11	11	—	20

77AB STA.

$Y_A = \frac{1}{2} \cdot \frac{1}{n}$



TABULAR FORM 2

REF. CODE: 601 Job

BENDING STRESSES AND AXIAL LOADS AT STATION 16

STA. 16

MODEL 485 PG. 111
DATE 2-5-55 REP. 110216

Form		Revised		2-20-55		2-20-55		2-20-55	
FL		or		Web		or		Web	
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TABULAR FORM 2

REF. CODE: col 10b

BENDING STRESSES AND AXIAL LOADS AT STATION 20

MODEL LL85 PG. 112
DATE 11/5/6 REP 11056
STA. 26

FL or Web	BENDING STRESSES Case and Condition				AXIAL LOADS Case and Condition				FL or Web
	①	②	③	④	⑤	⑥	⑦	⑧	
1	-25780								1
2	-27380								2
3	-28320								3
4	-28430								4
5	-28300								5
6	-27150								6
7	-26400								7
8	-24600								8
9	-22550								9
10	-20050								10
11	-18400								11
12	-16830								12
13	-15300								13
14	-16230								14
15	-18500								15
16	-20430								16
17	-21900								17
18	-23600								18
19	-24200								19
20	-23350								20
21	-22780								21
22	-20700								22
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Dec. Places for Cols.
All cols - 0 places

Prepared		DATE 2-9-55	LOCKHEED AIRCRAFT CORP. CALIFORNIA DIVISION	Page	TEMP.	STAT 113
Checked			TITLE STABILIZER MID STATION 21 SHEAR FLOWS	Model	L-185	
Approved				Report No.	11056	

$$d = 26.16 = 10 \text{ IN.}$$

1	2	3	4	5	6	7
WEB	AVERAGE MOMENT CONSTANT	ΔP $\textcircled{2} - \textcircled{5}$	$\frac{\Delta P}{d}$	q_{on} $= \sum \Delta P$	$q_{FWC.P.}$ $(5) + 785$	$q_{RET.C.P.}$ $(5) + 520$
1	11.6	-4390	-439	-439	+346	+81
2	9.3	-1600	-160	-599	186	-79
3	8.8	-140	-14	-613	172	-93
4	8.8	-120	-12	-625	160	-105
5	9.0	-110	-11	-636	149	-116
6	8.8	-120	-12	-648	137	-128
7	9.1	-80	-8	-656	129	-136
8	9.4	-90	-9	-665	120	-145
9	9.6	-120	-12	-677	108	-157
10	6.9	-110	-11	-688	97	-168
R.B.	48.4	-20	-2	-690	95	-170
12	6.0	-50	-5	-695	90	-175
13	8.2	+60	+6	-689	96	-169
14	7.8	70	7	-682	103	-162
15	7.6	60	6	-676	109	-156
16	7.4	60	6	-670	115	-150
17	7.5	120	12	-658	127	-138
18	7.1	120	12	-646	139	-126
19	7.4	160	16	-630	155	-110
20	7.8	210	21	-609	176	-89
21	9.9	1860	186	-423	362	+97
F.B.	52.2	3970	397	-26	+759	+494

$$\Sigma = 268.9$$

$$\Sigma \textcircled{2} \textcircled{5} = -139754 \text{ IN. LBS.} \quad M_y = +71,000 \text{ IN. LB.}$$

$$T = M_y - \Sigma \textcircled{2} \textcircled{5} = 71,000 + 140,000 = 211,000 \text{ IN. LB.}$$

$$q_o = \frac{211,000}{268.9} = +785 \text{ \#/IN.}$$

FWC.P.

$$q_o = \frac{140,100}{\text{RET.C.P.}} = +520 \text{ \#/IN.}$$

Prepared	NAME	DATE	LOCKHEED AIRCRAFT CORP. CALIFORNIA DIVISION	Page	TEMP. STAT. 14
Checked		2-14-56	TITLE	Model	L-185
Approved			STABILIZER ANALYSIS	Report No.	11056

DISCUSSION:

THE HORIZONTAL STABILIZER ANALYSIS IS BASED LARGELY ON THE RESULTS OF THE STATIC TEST AS PRESENTED IN L.R. 10571. THE LOWER SURFACE BENDING STRUCTURE WAS THE PORTION OF THE STABILIZER THAT FAILED AND AN OVERALL MARGIN IS BASED ON THIS STRENGTH LEVEL.

THE FRONT AND REAR BEAM FITTINGS ARE ANALYZED SEPERATELY BECAUSE THE COMBINED FIN AND STABILIZER LOADING CONDITION, WHICH IS CRITICAL FOR THE FITTINGS, WAS NOT COVERED BY DESTRUCTION TESTS. THESE FITTINGS PERFORM THREE FUNCTIONS: THEY SPLICE THE TWO HALVES OF THE STABILIZER BEAMS; THEY PROVIDE FIN SUPPORT POINTS AND REACT FIN LOADS; AND THEY PROVIDE FUSELAGE ATTACH POINTS AND TRANSMIT FIN AND STABILIZER LOADS INTO THE FUSELAGE.

FOR THE LOADING ON THE FITTINGS THE FOLLOWING ASSUMPTIONS ARE MADE: (a) SIDE SHEAR IS BEAMED TO THE FRONT AND REAR FITTINGS AND FIN BENDING IS DISTRIBUTED 65% TO THE FRONT FITTING AND 45% TO THE REAR FITTING. (b) STABILIZER SHEAR IS BEAMED TO THE FRONT AND REAR FITTINGS WITH 56% ON ONE SIDE AND 44% ON THE OTHER SIDE AND A 1.20 DYNAMIC FACTOR IS APPLIED TO THE TOTAL STABILIZER LOAD. FOR STABILIZER BENDING, 25% OF THE BENDING IS IMPOSED ON THE FRONT FITTING AND 5% ON THE REAR FITTING. THESE ARE CONSERVATIVE APPROXIMATIONS OF THE STABILIZER TO BEAM STIFFNESS RATIOS. (c) 85% OF THE UNSYMMETRICAL STABILIZER

Prepared		DATE 2-19-56	LOCKHEED AIRCRAFT CORP. CALIFORNIA DIVISION	STAT	PERM. 115
Checked			TITLE	Page	
Approved			<u>STABILIZER ANALYSIS</u>	Model	L-185
				Report No.	11056

DISCUSSION:

MOMENT IS ASSUMED REACTED BY THE FRONT FITTING SO A PART OF THIS MOMENT IS IMPOSED ON THE FRONT FITTING BY A UNIFORM BOX SHEAR FLOW. 25% OF THE UNSYMMETRICAL STABILIZER MOMENT IS ASSUMED REACTED BY THE REAR FITTING SO A PART OF THIS MOMENT IS IMPOSED ON THE REAR FITTING BY A UNIFORM BOX SHEAR FLOW. (2) THE MAXIMUM FIN LOAD IS ASSUMED ACTING IN THE AFT C.P. CONDITION FOR PURPOSES OF REAR BEAM FITTING ANALYSIS.

Prepared		DATE 2-19-56	LOCKHEED AIRCRAFT CORP. CALIFORNIA DIVISION	STAT	PERM. 116
Checked			TITLE STABILIZER ANALYSIS	Page	
Approved				Model	L-185
				Report No.	11056

BENDING STRUCTURE: (REF. DWS. E-7, E-13)

THE MARGIN FOR THE BENDING STRUCTURE IS COMPUTED BY COMPARISON TO THE STATIC TEST FAILURE OF THE LOWER SURFACE. THIS TEST IS OUTLINED IN L.R. 10571, PG. 5-1. THE 5400 LB. REFERRED TO IN THIS SECTION WAS THE LOAD USED TO ACHIEVE THE DESIGN BENDING MOMENT (REF. PG. 1-11) SO THE MARGIN IS BASED ON THE 6000 LB. DESIGN LOAD (1.5 x 4000#)

$$P_{FAILURE} = 6000 \times 1.65 = 9900 \text{ LB. (L.R. 10571 PG. 5-1)}$$

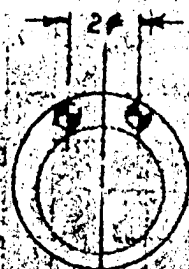
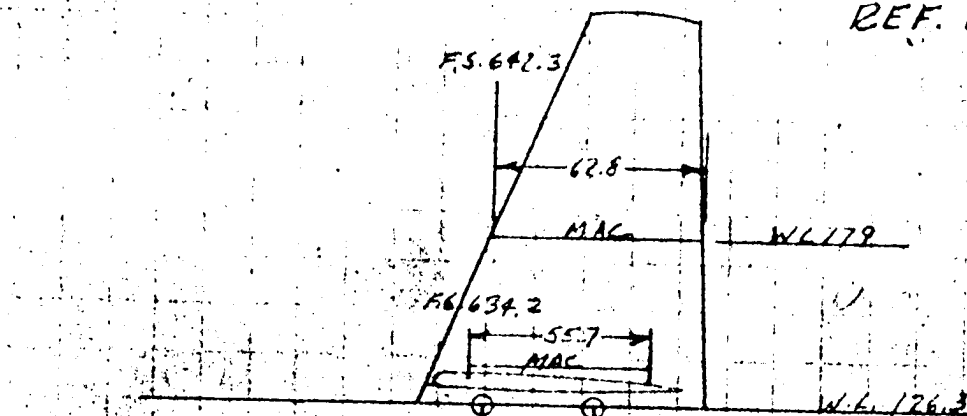
$$P_{DESIGN} = 6000 \times 1.12 \times 1.20 = 8070 \text{ LB. (REF. PGS. 105, 107)}$$

$$M.S. = 9900 / 8070 - 1 = \underline{\underline{.23}}$$

Prepared		DATE 9-29-55	LOCKHEED AIRCRAFT CORP. CALIFORNIA DIVISION	STAT 117
Checked			TITLE STABILIZER ANALYSIS	Page
Approved				Model L-105 Report No. 11056

GEOMETRY AND LOADS:

REF. DWG. E-20



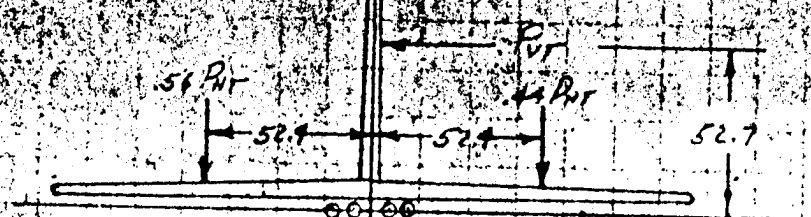
F.S. 638 FRAME

F.S. 638 F.S. 673



F.S. 673 FRAME

REF. DWG. E-7



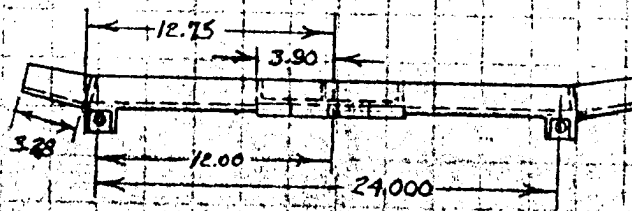
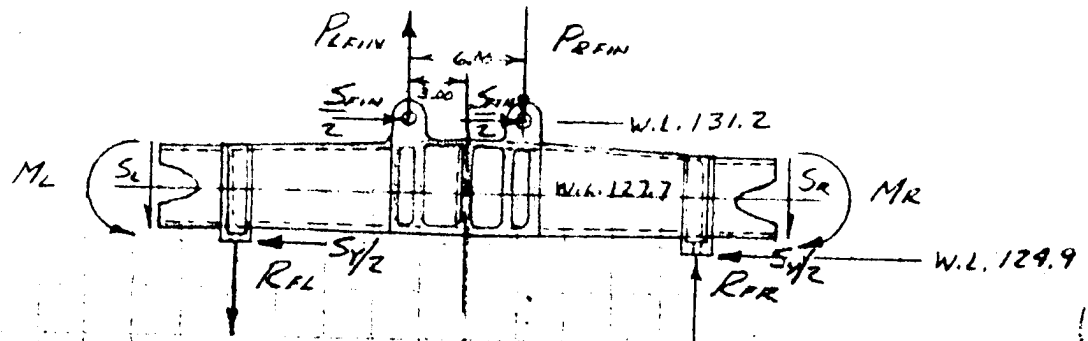
LOADS - REF L.R. 11055 PG. 6.02

COND.	FWD. C.P.	AFT C.P.
PNT *	6000 *	6000 *
% MAC	0	95
Pr	± 5580 *	± 3300 *
% MAC	5	97

Prepared		DATE 2-10-56	LOCKHEED AIRCRAFT CORP. CALIFORNIA DIVISION	Page	STAT PERM. 118
Checked			TITLE <u>STABILIZER ANALYSIS</u>	Model	L-185
Approved				Report No.	11056

FRONT BEAM FITTING:

REF. DWG. E-9



$$P_{LEIN} = P_{REIN} = 5580 \times .65 \times 97.8 / 6 = 28900 \text{ LB.}$$

$$S_{FIN} = 5580 \times 27.56 / 35 = 4390 \text{ LB.}$$

$$S_R = 6000 \times 1.20 \times .56 \times 38.8 / 35 = 4460 \text{ LB.}$$

$$S_L = 6000 \times 1.20 \times .44 \times 38.8 / 35 = 3510 \text{ LB.}$$

$$M_R = 6000 \times 1.20 \times .56 \times (52.4 - 12) / 4 = 40700 \text{ IN-LB}$$

$$M_L = 6000 \times 1.20 \times .44 \times (52.4 - 12) / 4 = 32000 \text{ IN-LB}$$

$$M_q = .85 \times .12 \times 52.4 \times 6000 \times 1.20 - 12 \times 4460 + 12 \times 3510 - 40700 + 32000 = 18350 \text{ IN-LB.}$$

$$q = 18350 / 2 \times 4.5 \times 24 = 85 \text{ LB/IN.}$$

Prepared	DATE 2-17-56	LOCKHEED AIRCRAFT CORP. CALIFORNIA DIVISION	STAT
Checked		TITLE STABILIZER ANALYSIS	Page 126
Approved			Model L-185 Report No. 11056

FRONT BEAM FITTING:

MAXIMUM SHEAR IS IN LEFT HAND WEB-

$$S = 3510 + 5980 - 85 \times 4.5 = 9110 \text{ LB.}$$

$$f_s = 9110 / 4.2 \times .09 = 24100 \text{ psi}$$

REF. SM 336 -

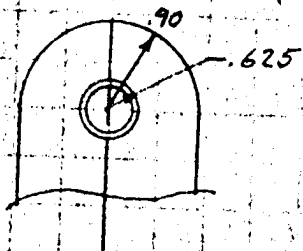
$$a = 7.3", b = 4.2"$$

$$a/b = .575 \sqrt{K} = 2.48 \text{ (SIMPLY SUPPORTED)}$$

$$(b/t)_e = 4.2 / .09 \times 2.48 = 18.8$$

$$F_{CR} = 26000 \text{ psi (SM 336, FIG 1C, CURVE 7)}$$

$$M.S. = 26000 / 24100 - 1 = \underline{\underline{.08}}$$

FIN FITTING LUG:

$$t = .62$$

7075-T6 FORGED BILLET
 $F_{TU} = 73000 \text{ psi}$

$$P_z = 28900^*, P_y = 2195^* \text{ (REF. PG. 118)}$$

$$P_{RES} = 29000 \text{ LB}$$

$$a/D = .90 / .625 = 1.44$$

$$K_{bL} = 1.22 \text{ (REF. SM 1C, FIG 2, CUTOFF "A")}$$

$$P_{BRU} = .625 \times .62 \times 1.22 \times 73000 = 34500 \text{ LB.}$$

$$M.S. = 34500 / 29000 - 1 = \underline{\underline{.19}}$$

Prepared	DATE 2-13-56	LOCKHEED AIRCRAFT CORP. CALIFORNIA DIVISION	Page	STAT. RM. 121
Checked		TITLE <u>STABILIZER ANALYSIS</u>	Model	L-185
Approved			Report No.	11056

FRONT BEAM FITTING:BOLTS:

THE FIN TO FITTING BOLTS ARE NAS 964-PB.
THESE ARE 1/2" DIA. IN DOUBLE SHEAR (DWG. E-19)

$$P = 28900 \text{ LB.} \quad (\text{REF. PG. 118})$$

$$P_{ALL} = 37300 \text{ LB.} \quad (\text{REF. S.M. 54-C})$$

$$M.S. = 37300 / 28900 - 1 = \underline{\underline{.29}}$$

THE FITTING TO FUSELAGE BOLTS ARE
MS 20006. 3/8" DIA. (REF. DWG. F-50)

THESE BOLTS ARE CHECKED FOR FIN LOAD
ONLY.

$$P = 6 \times 28900 / 24 = 7220 \text{ LB. (TENSION)}$$

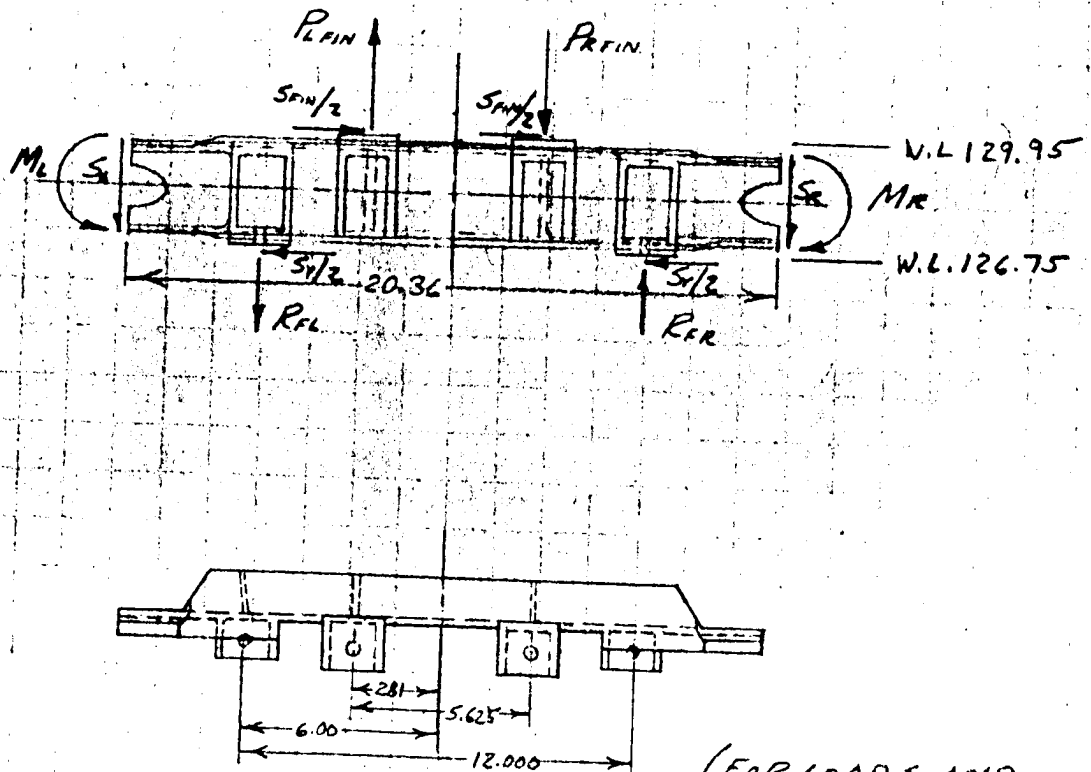
$$P_{ALL} = 12700 \text{ LB.} \quad (\text{REF. S.M. 54C})$$

$$M.S. = 12700 / 7220 - 1 = \underline{\underline{.76}}$$

Prepared		DATE 2-10-56	LOCKHEED AIRCRAFT CORP. CALIFORNIA DIVISION	STAT	TEMP.	PERM.
Checked			TITLE STABILIZER ANALYSIS	Page		122
Approved				Model	L-185	
				Report No.	11056	

REAR BEAM FITTING

(REF. DWG. E-11)



(FOR LOADS AND GEOMETRY REF. PG. 117)

$$P_{LFIN} = P_{RFIN} = 5580 \times .45 \times 49.05 / 5.625 = 21900 \#$$

$$S_{FIN} = 5580 \times 33.8 / 35 = 5390 \#$$

$$S_R = 6000 \times 1.20 \times .56 \times 26.85 / 35 = 3100 \#$$

$$S_L = 6000 \times 1.20 \times .44 \times 26.85 / 35 = 2430 \#$$

$$M_R = 6000 \times 1.20 \times .56 \times (52.4 - 6) / 20 = 9350 \text{ IN-LB.}$$

$$M_L = 6000 \times 1.20 \times .44 \times (52.4 - 6) / 20 = 7350 \text{ IN-LB.}$$

$$M_F = .25 \times .12 \times 52.4 \times 6000 \times 1.20 - 6 \times 3100 + 6 \times 2430 - 9350 + 7350 = 5300 \text{ IN-LB.}$$

$$q = 5300 / 2 \times 3 \times 12 = 74 \text{ LB/IN}$$

Prepared		DATE 2-13-56	LOCKHEED AIRCRAFT CORP. CALIFORNIA DIVISION	Page	STAT. 123
Checked			TITLE STABILIZER ANALYSIS	Model	L-185
Approved				Report No.	11056

REAR BEAM FITTING:

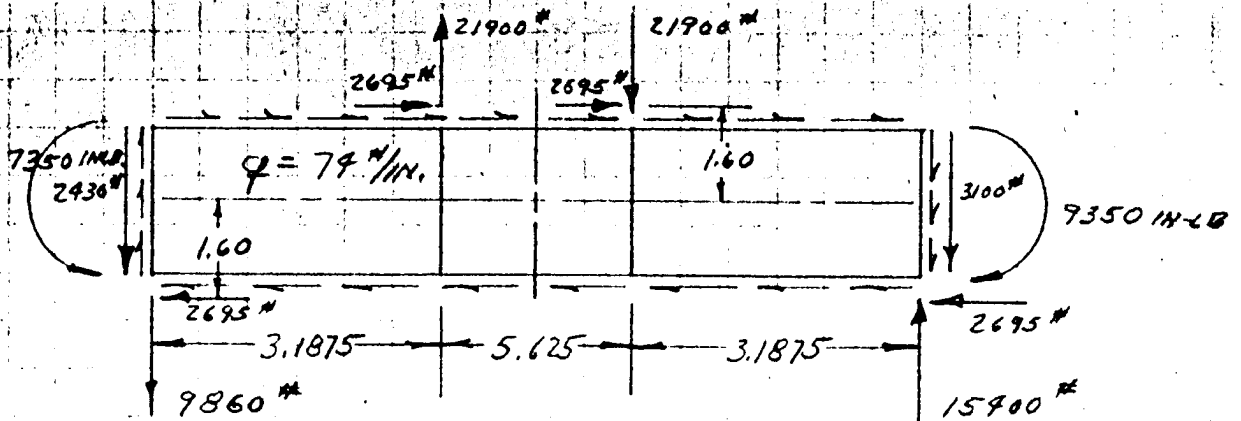
$$M_{TOT} = 3.2 \times 5390 + 21900 \times 5.625 + .25 \times .12 \times 52.8 \times 6000 \times 1.20$$

$$= 151770 \text{ IN-LB}$$

$$S_{ZTOT} = 6000 \times 1.20 \times 26.85 / 35 = 5530 \text{ LB.}$$

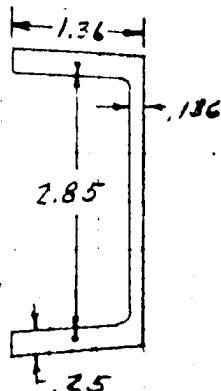
$$R_{ER} = 151770 / 12 + 5530 / 2 = 15400 \text{ LB.}$$

$$R_{FL} = 151770 / 12 - 5530 / 2 = 9860 \text{ LB.}$$

TOTAL LOADING ON FITTING:SECTION AT LEFT HAND FITTING:

$$M = 7350 + 9860 \times 3.1875 + 2430 \times 3.1875 - 1.60 \times 2695$$

$$- 3 \times 3.1875 \times 79 = 41530 \text{ IN-LB.}$$



REF. DWG. E-11
7075-T6 FORGED BILLET

$$fb = 41530 / 2.85 \times 1.36 \times .25 = 42800 \text{ PSI}$$

$$b/t = 4.9, F_{CL} = 72000 \text{ PSI (SM 110 FIG. 10)}$$

$$M.S. = 72000 / 42800 - 1 = .68$$

Prepared		DATE 2-19-56	LOCKHEED AIRCRAFT CORP. CALIFORNIA DIVISION	STAT. ERM. 1124
Checked			TITLE STABILIZER ANALYSIS	Model L-185
Approved				Report No. 11056

REAR BEAM FITTING:

MAXIMUM SHEAR IS IN LEFT HAND WEB -

$$S = 9860 + 2430 - 3 \times 74 = 12070 \text{ LB.}$$

$$f_s = 12070 / 3 \times .136 = 31700 \text{ PSI}$$

$$F_{50} = 44000 \text{ PSI} \quad (\text{ANC-5 TABLE 3.111J})$$

$$M.S. = \frac{44000}{31700} - 1 = \underline{\underline{.38}}$$

BOLTS:

THE FIN TO FITTING BOLTS ARE MS 20009
THESE ARE 7/16" DIA. IN TENSION (REF. DWG. E-19)

$$P = 21900 \text{ LB} \quad (\text{REF. PG. 122})$$

$$P_{ALL} = 29800 \text{ LB} \quad (\text{REF. SM 54C})$$

$$M.S. = 29800 / 21900 - 1 = \underline{\underline{.36}}$$

THE FITTING TO FUSELAGE BOLTS ARE
M.S. 20007; THESE ARE 7/16" IN TENSION. (DWG. F-50)

THE TENSION LOAD ON THESE BOLTS IS
16770 LB. (REF. L.R. 11057, PG. 70)

$$P_{ALL} = 17100 \text{ LB} \quad (\text{REF. SM 54C})$$

$$M.S. = 17100 / 16770 - 1 = \underline{\underline{.03}}$$

Prepared		DATE 2-15-56	LOCKHEED AIRCRAFT CORP. CALIFORNIA DIVISION	STAT. PERM. Page 125
Checked			TITLE FIN GENERAL DESCRIPTION	Model L-185
Approved				Report No. 11056

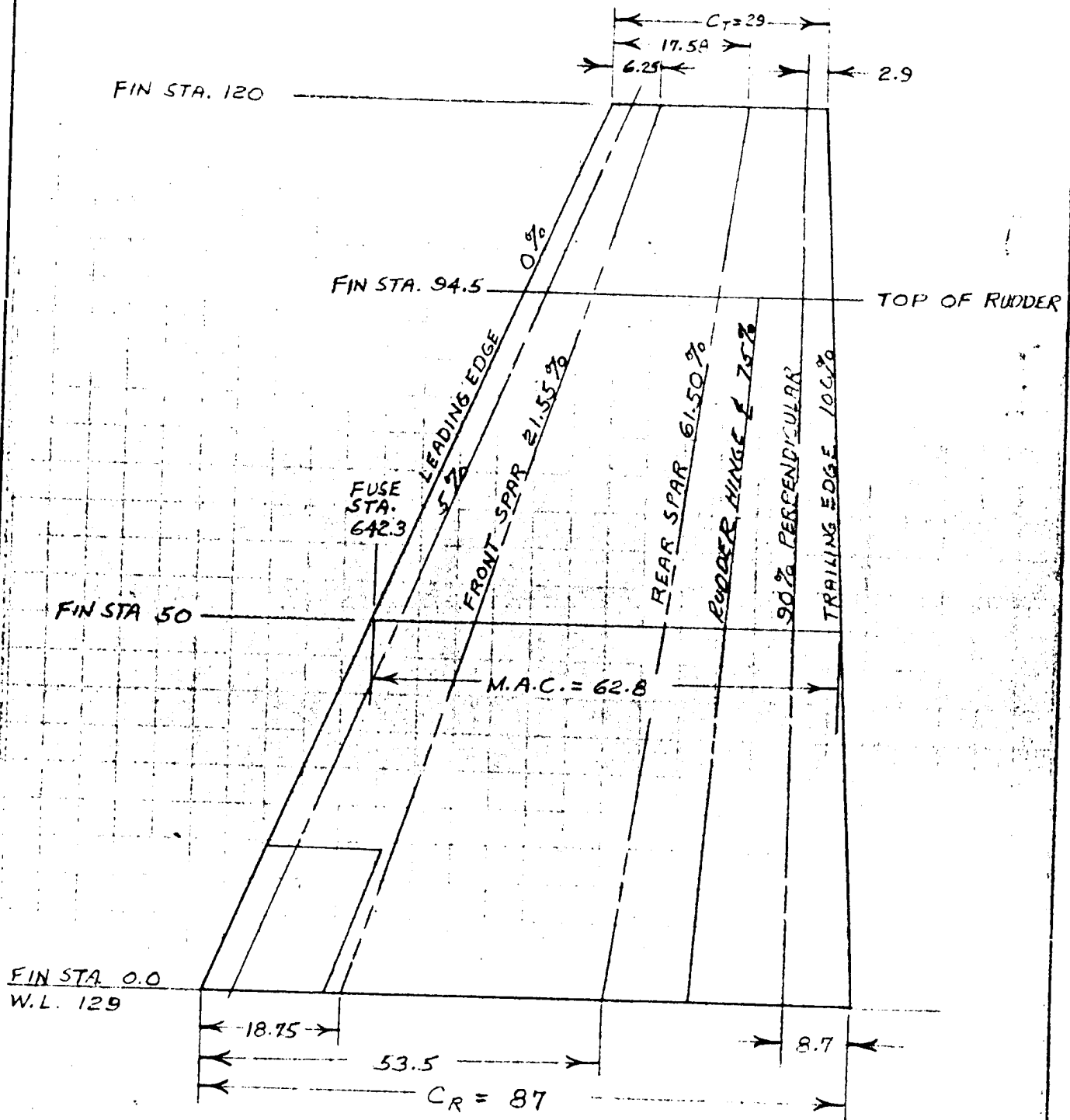
THE FIN GEOMETRY IS SHOWN ON PG. 126. THE FIN IS OF CONVENTIONAL GEOMETRY AND CONSTRUCTION HAVING A FRONT SPAR AT 21.55% CHORD LINE, A REAR SPAR AT 61.50% CHORD LINE, AND A RUDDER HINGE LINE AT 75% CHORD LINE. THE RUDDER DOES NOT EXTEND THE FULL LENGTH OF THE FIN BUT CUTS OFF AT FIN STA. 94.5. THE 90% CHORD LINE IS VERTICAL FOR THIS GEOMETRY. THE SURFACE SUPPORT STRUCTURE CONSISTS OF LIGHT RIBS SPACED AT APPROXIMATELY SIX INCH INTERVALS WITH AUXILIARY FORMERS IN THE LEADING EDGE BETWEEN THE RIBS UP TO FIN STA. 46.5. THE ROOT RIB IS OF HEAVIER CONSTRUCTION HAVING EXTRUDED CAPS TO REDISTRIBUTE KICK LOADS RESULTING FROM THE SWEEP OF THE SPARS. THERE ARE ALSO TWO SPANWISE STRINGERS ON EACH SURFACE BETWEEN THE SPARS EXTENDING FROM THE ROOT RIB TO FIN STA. 15.875. TWO STEEL FITTINGS AT THE BASE OF THE SPARS SERVE TO ATTACH THE FIN TO THE STABILIZER FITTINGS.

Prepared		DATE 2-19-56	LOCKHEED AIRCRAFT CORP. CALIFORNIA DIVISION	STAT	PERM. 126
Checked			TITLE <u>GENERAL DESCRIPTION</u>	Page	
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FIN GEOMETRY

REF. DWG. E-20

AIRFOIL 63A 007

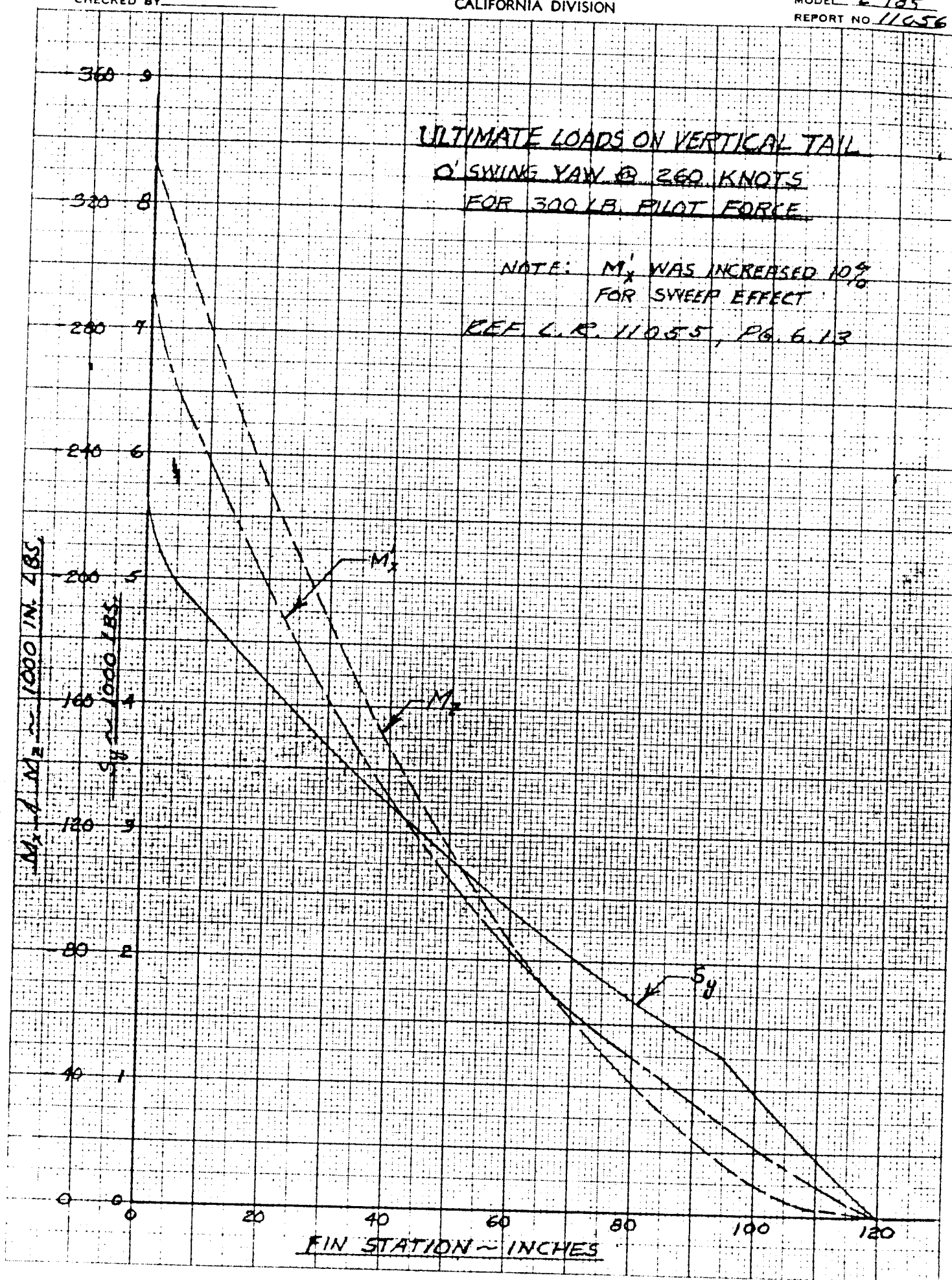


$$C = 87 - \frac{5E}{120} \times \text{FIN. STA.}$$

ULTIMATE LOADS ON VERTICAL TAIL
O' SWING YAW @ 260 KNOTS
FOR 300 LB. PILOT FORCE

NOTE: M_x WAS INCREASED 10%
FOR SWEEP EFFECT

REF L.R. 11055, PG. 6.13



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Checked		TITLE FIN ANALYSIS		Model	L-185
Approved				Report No.	11056

DISCUSSION:

THE FIN BENDING STRUCTURE CONSISTS OF TWO SPARS OF SIMILAR CONSTRUCTION WHICH TRANSMIT FIN BENDING TO THE STABILIZER BY MEANS OF STEEL FITTINGS AT THE BASE OF THE SPARS. THE CAPS FOR BOTH SPARS ARE MACHINED FROM A 7075-T6 EXTRUDED SECTION AND THE WEBS ARE 7075-T6 SHEET.

THE BENDING LOADS ARE ASSUMED DISTRIBUTED 54% TO THE FRONT SPAR AND 46% TO THE REAR SPAR AND A 1.20 FACTOR IS APPLIED TO THE FRONT SPAR TO ACCOUNT FOR FUSELAGE FLEXIBILITY. THIS RESULTS IN A FINAL DISTRIBUTION OF 65%-46% TO THE TWO BEAMS WHICH IS REFLECTED IN THE BEAM BENDING MOMENT CURVES OF PG. 130. IN ADDITION, A FACTOR OF 1.10 IS APPLIED TO THE TOTAL FIN BENDING MOMENT TO ACCOUNT FOR SWEEP EFFECTS AND THIS FACTOR IS INCLUDED IN THE M_y CURVE OF PG. 127.

THE SKIN SHEAR FLOW IS CALCULATED FROM APPLIED TORSION AND THE TORSION IS ASSUMED RESISTED BY THE BOX BEAM BETWEEN THE TWO SPARS. THIS CONSERVATISM IS CONSIDERED TO COVER ANY ADDITIONAL VQ/I SHEARS WHICH MAY BE PRESENT IN THE SURFACE SKIN.

UNPUBLISHED TEST DATA FOR CSK. RIVETS WHICH ARE OUTSIDE THE LISTED SKIN THICKNESS RANGE GIVE VALUES OF 213# FOR AD4 RIVETS CSK. IN .025 ALUMINUM AND 298# FOR AD5 RIVETS CSK. IN .032 ALUMINUM. THESE VALUES ARE USED HEREIN.

THE FIN STRUCTURE IS FURTHER

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DISCUSSION: (CONT'D)

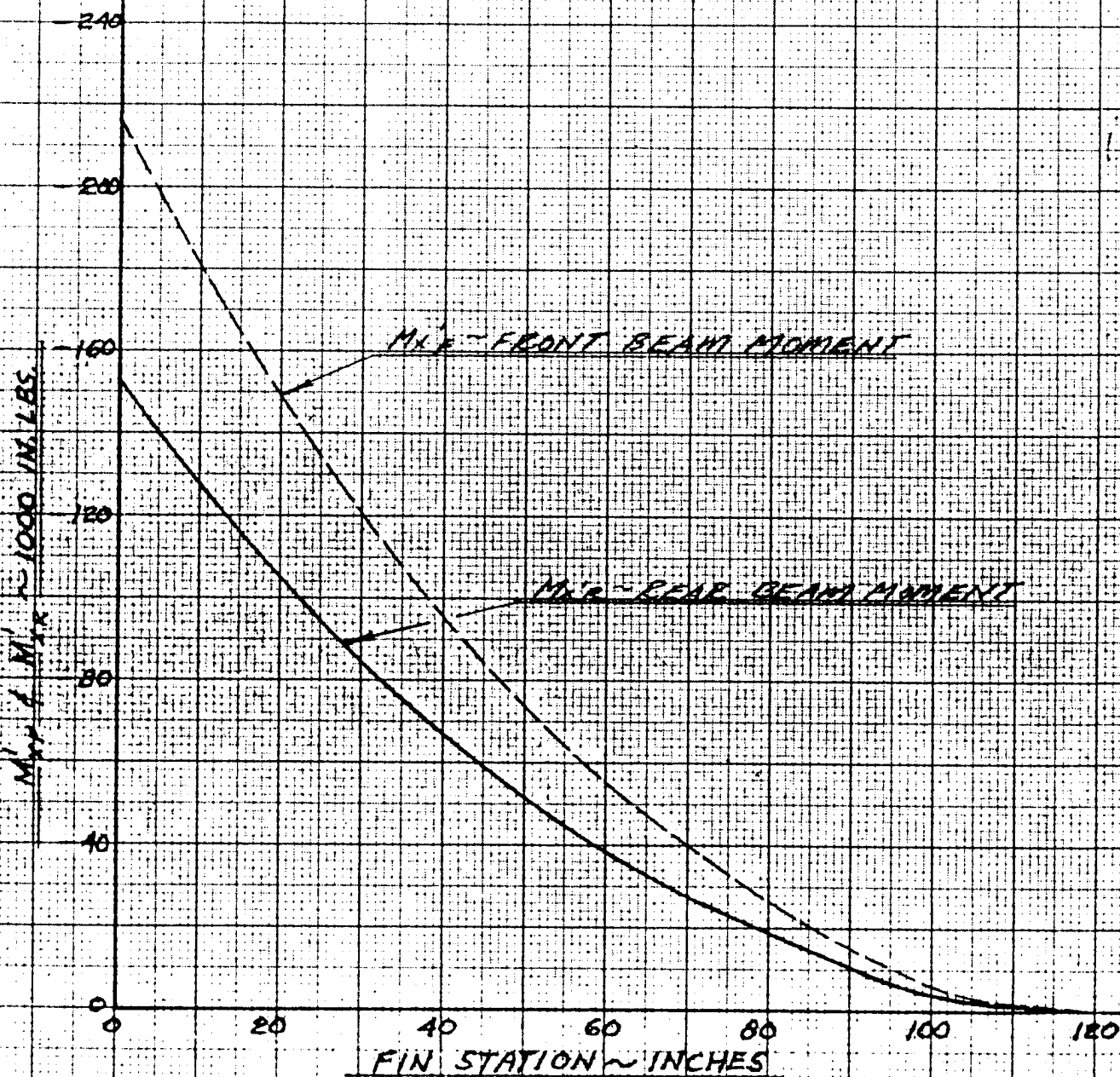
SUBSTANTIATED BY THE AIRPLANE STATIC TEST WHICH SUBJECTED IT TO DESIGN ULTIMATE LOADS WITHOUT FAILURE. (REF. L.R. 10571 Pg. 1-5)

ULTIMATE LOADS ON FIN SPARS

$$M'_{XR} = .65 M'_x$$

$$M'_{XR} = .46 M'_x$$

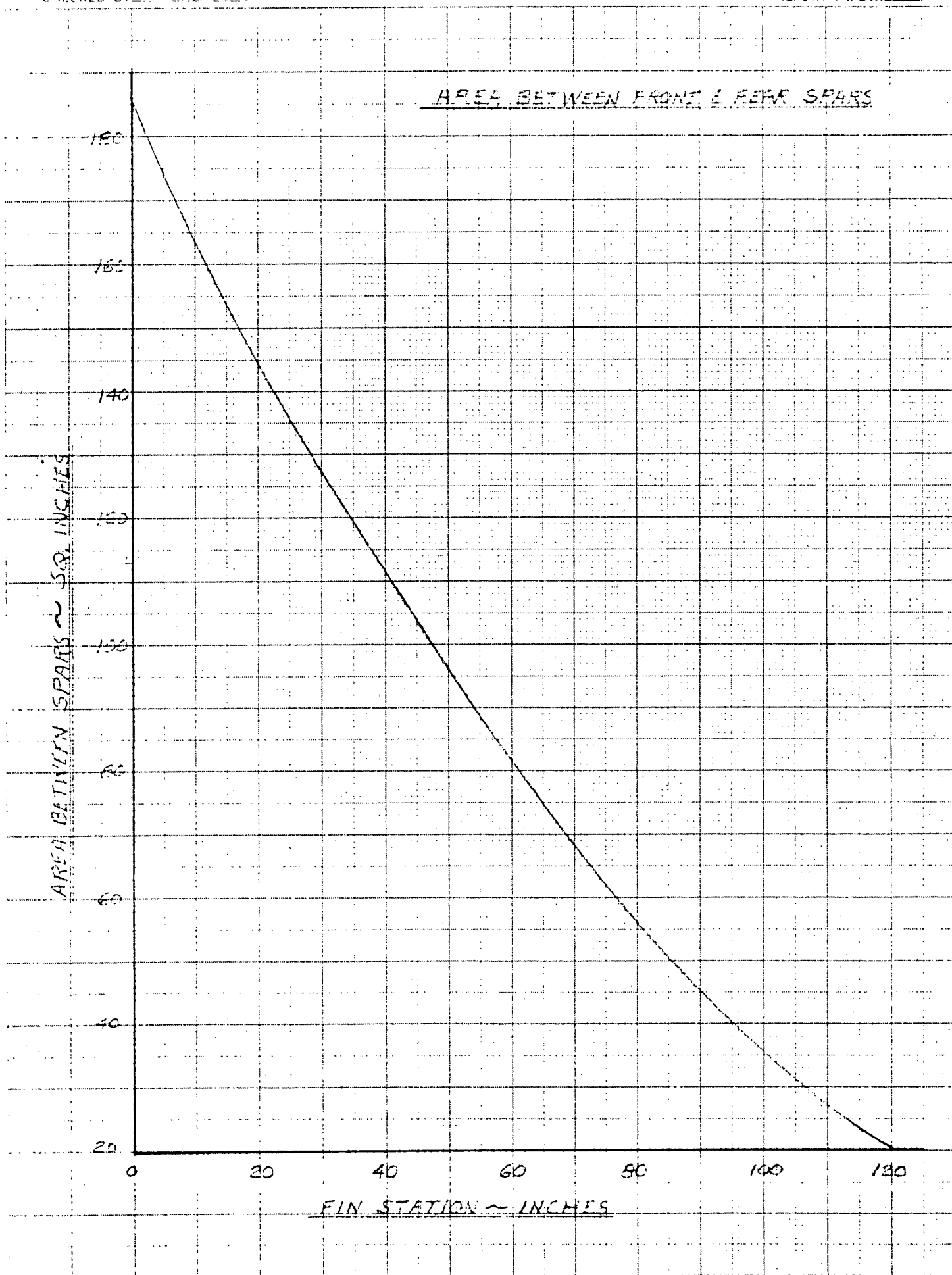
(REF. PG. 127)



1. LEONARD, CYBER CO. NO. 128 50 X 50 UNIFORMS LFRINCH 128 70 DIVISION



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FRONT AND REAR BEAM SHEAR FLOW:

1	2	3	4	5	6	7	8	9	10	11
FIN STA.	SHEAR (lb/in)	C.P. TO C.A. (in)	MT 2 x 3	2A (P ₂ , 1.2)	9T (A/15)	h ₁ (in)	h ₂ (in)	8 ₃ (in)	9 ₄ (in)	4 ₅ (in)
0	5580	30.4	170000	370	960	4.80	4.10	756	627	1216
10	4700	29.1	135000	326	414	4.50	3.90	679	554	768
30	3680	25.3	93000	254	366	4.10	3.40	584	498	864
50	2800	21.9	61500	192	319	3.60	3.00	505	429	748
70	2030	18.4	37900	136	278	3.00	2.60	440	359	637
70	1340	15.2	21200	90	236	2.50	2.10	361	304	540
110	450	11.8	5900	54	98	1.90	1.60	154	129	227

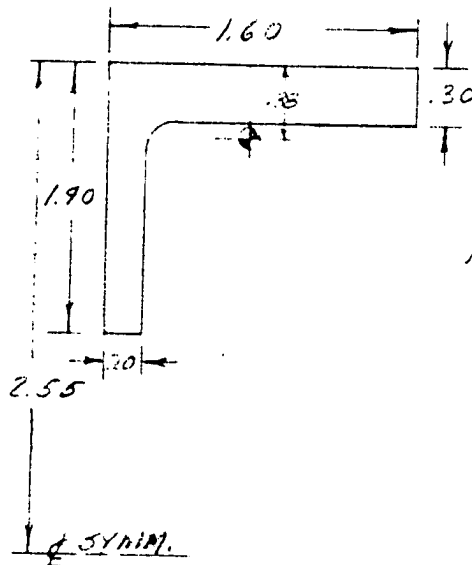
* THE CONDITION FOR WHICH TORSIONAL SHEAR FLOW IS ADDITIVE ON THE REAR BEAM HAS LESS SHEAR AND RESULTS IN A LOWER REAR BEAM SHEAR FLOW.

* ELASTIC AXIS IS ASSUMED TO BE AT 40% CHORD LINE. C.P. IS AT 5% CHORD LINE.

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FRONT BEAM:FIN STA. 9.2

REF. DWG. E-1



$$A = .705 \text{ IN}^2$$

7075-T6 EXTRUSION

(REF. SM1110 FB11)

ITEM	Ln	Ln/c	AN	F _u	P
1	1.60	5.33	.48	79000	37900
2	1.40	7.00	.28	69000	19300
			.76		57200

$$F_{uL} = 57200 / .76 = 75300 \text{ psi}$$

$$M = 184000 \text{ IN-LE (REF. PG 130)}$$

$$f_c = 184000 / 4.34 \times .705 = 60100 \text{ psi}$$

$$M.S. = 75300 / 60100 - 1 = \underline{\underline{.25}}$$

FOR THE TENSION CAP THERE IS A 5/16 BOLT THRU THE .30 LEG AND A 1/4 BOLT THRU THE .20 LEG. $A_{NET} = .561 \text{ IN}^2$

$$f_T = 184000 / 4.34 \times .561 = 75500 \text{ psi}$$

$$F_{Tu} = 86000 \text{ psi (REF. ANC-5 TAB. 3.111A)}$$

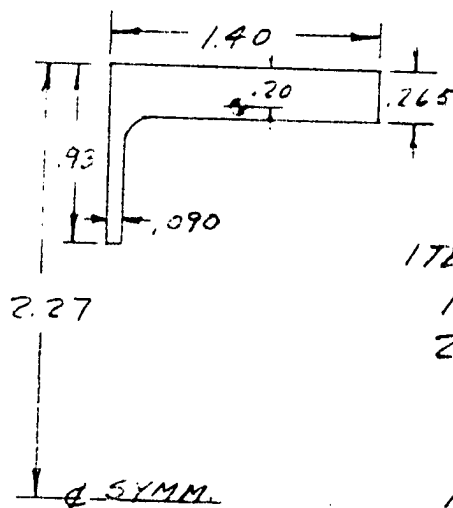
$$M.S. = 86000 / 75500 - 1 = \underline{\underline{.14}}$$

STAT

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FRONT BEAM:FIN STA. 28.125

REF DWG. E-1



$$A = .435$$

7075-T6 EXTRUSION

(REF. SM 110 FIG. 11)

ITEM	b _n	b _n /t	A _n	F _u	P
1	1.40	5.3	.371	79000	29300
2	.93	10.3	.084	47000	3950
			.455		33250

$$F_{u} = 33250 / .455 = 73200 \text{ psi}$$

$$M = 126000 \text{ psi} \quad (\text{REF. PG 13})$$

$$f_c = 126000 / 4.14 \times .435 = 70000 \text{ psi}$$

$$M.S. = 73200 / 70000 - 1 = \underline{\underline{.04}}$$

BEAM WEB:

LOWER SECTION OF WEB IS .051 7075-T6 ALCL.
PANEL DIMENSIONS ARE 3.80 BY 4.60 INCHES

$$F_{scr} = K_{ss} E (t/h)^2 \quad (\text{REF TN 2661 PG. 42})$$

$$K_{ss} = 7 \quad (\text{TN 2661 FIG 12a})$$

$$F_{scr} = 7 \times 10.3 \times 10^4 \times (.051/3.8)^2 = 13000 \text{ psi}$$

$$q_{cr} = 13000 \times .051 = 662 \text{ LB./IN.}$$

$$q = 1216 \text{ LB./IN.} \quad (\text{REF. PG. 13})$$

$$q/q_{cr} = 1.83$$

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FRONT BEAM:
WEB: (CONT'D.)

$$K = .13 \quad (TN 2661 FIG. 13)$$

$$WDAG. TEN. = Kq = 1216 \times .13 = 158$$

RIVETS ARE SPACED AT .685 (DWG. E-1)

$$\eta = 1 - D/p = 1 - .188/.685 = .72$$

$$R_s = 1216 / .051 \times 94000 \times .72 = .75$$

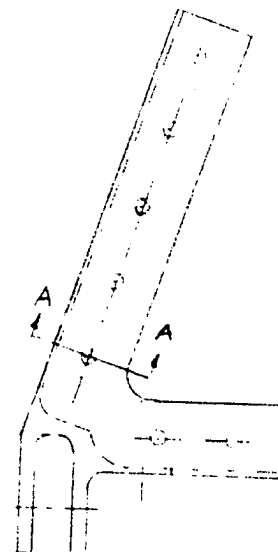
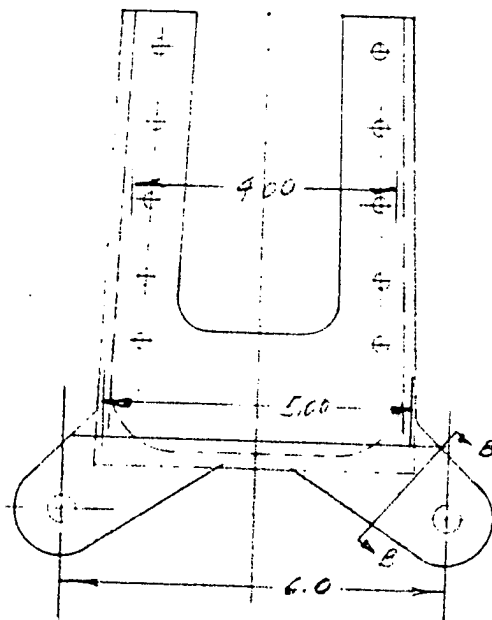
$$R_z = 158 / .051 \times 94000 \times .72 = .06$$

$$M.S. = 1 / \sqrt{.75^2 + .06^2} - 1 = .33$$

FRONT SPAR FITTING:

REF. DWG. E-2

160-180 000 PSI H.T. STEEL



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FRONT SPAR FITTING:

$$M_x = 216000 \text{ IN-LB}$$

(REF. PG. 130)

$$S_y = 4340 \text{ LB.}$$

(REF. PG. 127)

$$\text{FRONT BEAM SLOPE IS } 18.32^\circ \quad (\text{REF. PG. 126})$$

$$\text{KICK MOMENT} = 216000 \sin 18.32^\circ = 67900 \text{ IN-LB.}$$

$$\text{KICK LOAD} = 67900/5 = 13600 \text{ LB.}$$

$$\text{VERTICAL MOM.} = 216000 \cos 18.32^\circ = 205000 \text{ IN-LB}$$

$$\text{VERTICAL COUPLE LOAD} = 205000/6 = 34200 \text{ LB.}$$

KICK LOAD ATTACHMENT CONSISTS OF 2 5/16" BOLTS
ERG. IN .176 2024-T4 EXTRUSION AND 1 1/4" SCREW
ERG. IN .125 2024-T4 EXTRUSION (REF. DWG. E-19, SHT. 2)

$$P_{ALL} = 2 \times .312 \times .176 \times 114000 + .25 \times .125 \times 114000 = 16080$$

$$M.S. = 16080/13600 - 1 = \underline{\underline{.19}}$$

PRIMARY BENDING COUPLE IS IMPOSED ON THE
FITTING THROUGH 5 5/16" H.S. SCREWS AND 6 1/8" H.S.
BOLTS CRITICAL IN SHEAR. (REF. DWG. E-19, SHT. 2)

$$P = 216000/4 = 54000 \text{ LB.}$$

$$P_{ALL} = 5 \times 7300 + 6 \times 4650 = 69900 \text{ LB (REF. SMT 59C)}$$

$$M.S. = 69900/54000 - 1 = \underline{\underline{.19}}$$

SEC A-A:

$$\text{NET SECTION} = .90 \times .25 + .75 \times .25 = .412 \text{ IN}^2$$

$$f_c = 54000/.412 = 131000 \text{ PSI}$$

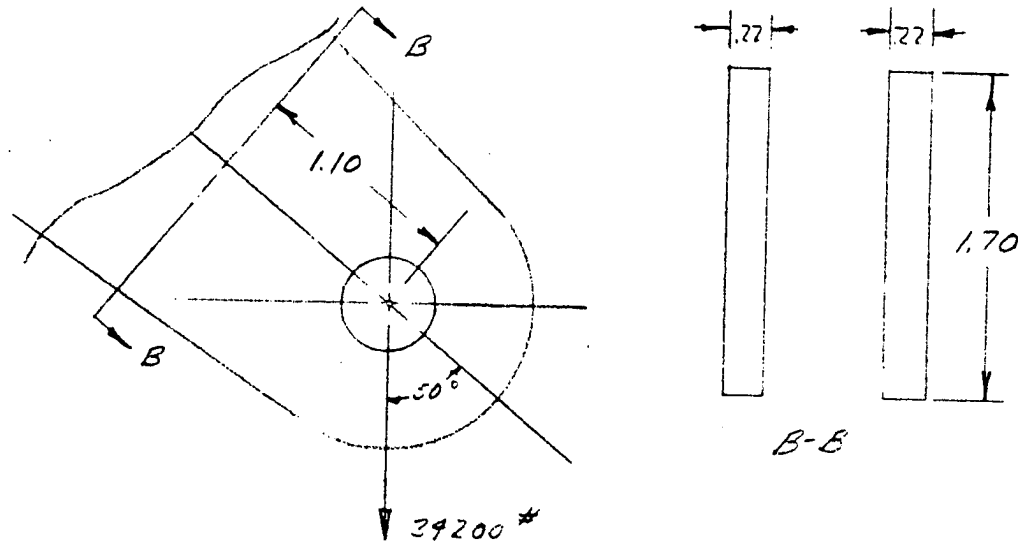
$$M.S. = 131000/131000 - 1 = \underline{\underline{.22}}$$

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FRONT BEAM FITTING:

SEC. B-B

REF. DWG. E-2



$$P = 39200 \cos 50^\circ = 22000 \text{ LB.}$$

$$M = 39200 \sin 50^\circ \times 1.10 = 28800 \text{ IN.-LB.}$$

$$f_c = 22000 / 1.7 \times .94 = 29900 \text{ psi}$$

$$f_s = 26200 / 1.7 \times .94 = 35000 \text{ psi}$$

$$f_L = 6 \times 28800 / (.94 \times 1.7^2) = 136000 \text{ psi}$$

$$(M_c / I_{x_{all}}) = 237000 \text{ psi} \quad (\text{REF. SM 53C FIG. 14,})$$

$$R_b = 136000 / 237000 = .58$$

$$R_t = 29900 / 99000 = .19$$

$$R_s = 35000 / 99000 = .35 \quad [\text{ANGS 745.2.111(b)}]$$

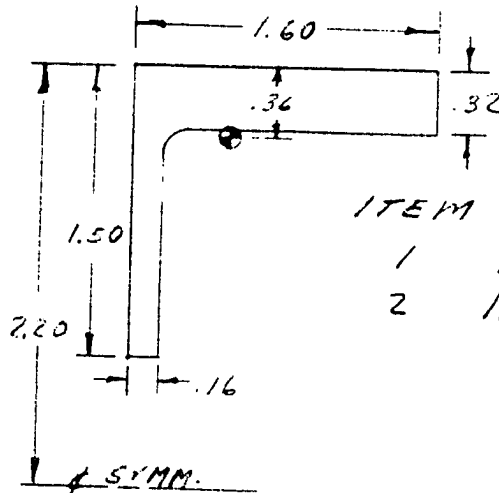
$$M.S. = \frac{1}{\sqrt{(.58 + .19)^2 + .35^2}} - 1 = \underline{\underline{.19}}$$

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BEAM SPAR:

FIN STA. 9.0

REF. DWG. E-3



$$A = .706 \text{ IN.}^2$$

7075-T6 EXTRUSION

(REF. SM 110 FIG. 11)

ITEM	b_h	b_h/t	A_h	F_{cu}	P
1	1.60	5.0	.512	80000	41000
2	1.50	9.4	.240	50000	12000
			.752		53000

$$F_{cu} = 53000 / .752 = 70500 \text{ psi}$$

$$M = 130000 \text{ IN-LB (REF. PG. 130)}$$

$$f_c = 130000 / 3.68 \times .706 = 50000 \text{ psi}$$

$$M.S. = 70500 / 50000 - 1 = .41$$

FOR THE TENSION CAP THERE IS A $5/16$ BOLT THRU THE .32 LEG AND A $1/4$ BOLT THRU THE .16 LEG. $A_{NET} = .566 \text{ IN.}^2$

$$f_c = 150000 / 3.68 \times .566 = 62300 \text{ psi}$$

$$F_{cu} = 86000 \text{ psi (REF. AWC5 TAB. 3.111A)}$$

$$M.S. = 86000 / 62300 - 1 = .38$$

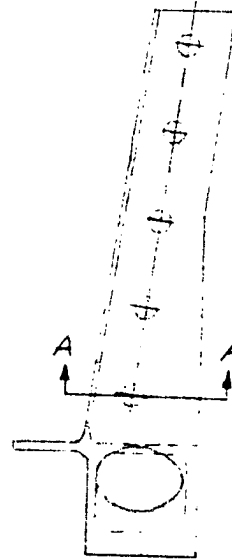
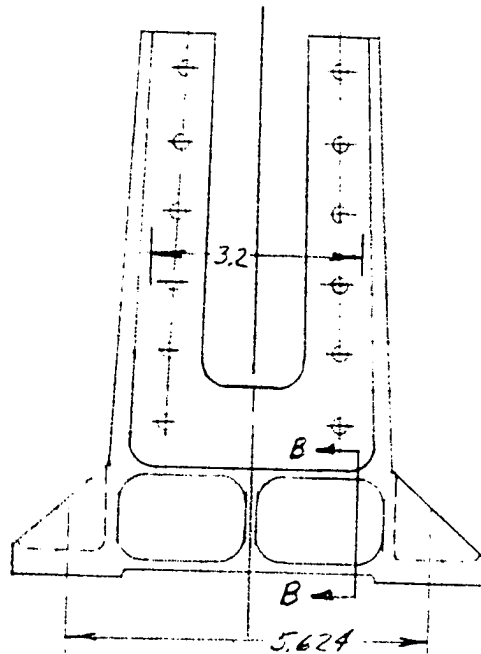
THE REMAINDER OF THE CAP AND WEB IS LESS CRITICAL THAN THE SIMILAR FRONT BEAM BECAUSE OF THE LOWER LOADS.

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REAR SPAR FITTING:

REF. DWG. E-4

150-170000 H.T. STEEL



$$M_{X'R} = 153000 \text{ IN-LB}$$

(REF. PG. 15)

$$\text{REAR SPAR SLOPE} = 7.72^\circ$$

(REF. PG. 15C)

$$\text{KICK MOMENT} = 153000 \times \sin 7.72^\circ = 20600 \text{ IN-LB}$$

$$\text{KICK LOAD} = 20600 / 3.2 = 6430 \text{ LB.}$$

$$\text{VERTICAL MOMENT} = 153000 \cos 7.72^\circ = 151300 \text{ IN-LB.}$$

$$\text{VERTICAL COUPLE LOAD} = 151300 / 5.624 = 26900 \text{ LB.}$$

PRIMARY BENDING COUPLE IS IMPOSED ON THE FITTING THROUGH 5 ⁵/₁₆ H.S. SCREWS AND 6 ¹/₄ H.S. BOLTS CRITICAL IN SHEAR (REF DWGS. E-3 & E-19 SH. 3)

$$P = 153000 / 3.2 = 47800 \text{ LB.}; P_{ALL} = 64400 \text{ (REF. PG. 13C)}$$

$$M.S. = 64400 / 47800 - 1 = \underline{\underline{.35}}$$

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REAR SPAR FITTING:

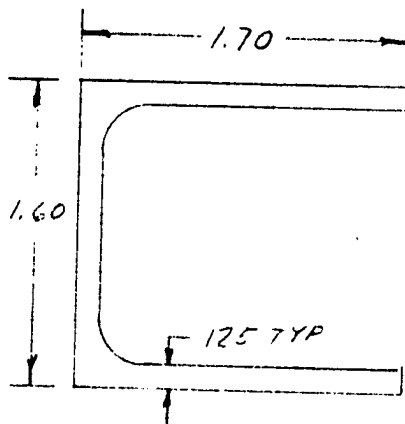
SEC. A-A

$$NET\ SECTION = 1.44 \times .235 + .75 \times .10 = .413$$

$$f_t = 47800 / .413 = 116000\ psi$$

$$M.S. = 150000 / 116000 - 1 = \underline{\underline{.29}}$$

SEC. B-B



$$I = 1.70 \times 1.60^3 / 12 - 1.575 \times 1.35^3 / 12 = .260$$

$$M = 26900 \times 1.00 = 26900\ IN-LB$$

$$M_c / I = 26900 \times .74 / .26 = 76500\ psi$$

$$L / c = 1.575 / .125 = 12.6$$

CURVE C FOR 1/2 HARD STAINLESS STEEL
($F_{70} = 150000\ psi$) IS USED. (REF. SM110 FIG. 18)

$$F_{cc} = 82000\ psi \quad (REF. SM110 FIG. 18)$$

$$M.S. = 82000 / 76500 - 1 = \underline{\underline{.07}}$$

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SURFACE SKIN:

(REF. DWG E-19)

.04" 75576 ALL

THE PANEL BOUNDED BY THE REAR EEAH
AND FIN STA. 10.75 AND FIN STA. 15.875 RIBS
IS CHECKED.

$$q = 914 \text{ LB/IN.}$$

(REF. PG. 132)

$$d = 5.125 \text{ IN.} \quad h = 10.5 \text{ IN.} \quad t = .090 \text{ (REF. DWG E-19)}$$

$$K_{ss} = 5.85$$

(REF. NACA TN 2661 FIG. 122)

$$q_{CR} = 5.85 \times 10.3 \times 10^6 \times (.090)^3 / (5.125)^2 = 147 \text{ LB/IN. (T.N. 2661 PG. 42)}$$

$$q/q_{CR} = 914/147 = 2.82$$

$$K = .22$$

(TN 2661 FIG. 12)

$$q_{DIAG. TUN.} = qK = 914 \times .22 = 91 \text{ LB/IN.}$$

$$q_{TOT} = \sqrt{914^2 + 91^2} = 924 \text{ LB/IN.}$$

ATTACHMENTS ARE CRITICAL; THEY ARE
A05 CSK. RIVETS AT .75 CC (REF. DWG E-19)

$$q_{ALL} = 397/.75 = 530 \text{ LB/IN. (REF. SM 756)}$$

$$M.S. = 530/924 - 1 = \underline{\underline{.25}}$$

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SURFACE SKIN:32 752761-1

THE PANEL BOUNDED BY THE FRONT AND REAR BEAMS AND THE FIN STA. 28.125 AND FIN STA. 34.25 RIBS IS CHECKED.

$$q = 366 \text{ LB/IN.} \quad (\text{REF. PG. 133})$$

$$d = 5.2 \text{ IN.}; h = 29; t = .032 \quad (\text{REF. DWG. E-19})$$

$$K_{66} = 5.1 \quad (\text{REF. NACA T.N. 2661 FIG. 12a})$$

$$q_{cr} = 5.1 \times 10.3 \times 10^6 \times (.032)^3 / (5.2)^2 = 69 \text{ LB/IN} \quad \left(\begin{array}{l} \text{T.N. 2661} \\ \text{PG. 42} \end{array} \right)$$

$$q/q_{cr} = 366/69 = 5.72$$

$$K = .365 \quad (\text{T.N. 2661 FIG. 12})$$

$$q_{\text{DIAG. TEN}} = qK = 366 \times .365 = 134 \text{ LB/IN.}$$

$$q_{\text{TOT.}} = \sqrt{366^2 + 134^2} = 390 \text{ LB/IN.}$$

ATTACHMENTS ARE CRITICAL; THEY ARE .405 CSK. RIVETS AT .75 CC (REF. DWG. E-19)

$$q_{\text{ALL}} = 298 / .75 = 397 \text{ LB/IN.} \quad (\text{REF. PG. 133})$$

$$M.S. = 397/390 - 1 = \underline{\underline{.02}}$$